THE BRAIN OF THE CAT.

(FELIS DOMESTICA.)

1. PRELIMINARY ACCOUNT OF THE GROSS ANATOMY.

WITH FOUR PLATES.

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(*Read before the American Philosophical Society, July 15, 1881.*)

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This paper is in four parts:—A. Introduction. B. The macroscopic vocabulary of the brain. C. List of points to be elucidated. D. Explanation of the plates.

A. INTRODUCTION.

The present paper is the first of a series of contributions to the knowledge of the brain of the domestic cat. A second—*A Description of the Cerebral Fissures, together with their Synonymy*—has been nearly ready for a year, and a brief preliminary abstract of it has been published (Wilder *8*),* but it will more properly follow the present general account of the entire brain.

The title of the series is made comprehensive in order that the subject may be discussed from any point of view. I hope, therefore, that others

*This number refers to the list at the end of this paper. In that list, the names of the *authors* are placed in *alphabetical order*. The titles of *separate works* are designated by *letters*, and their order has no significance. The titles of *papers* are *numbered*. In the case of papers published between 1800 and 1873, the numbers correspond to those in the chronological "Catalogue of Scientific Papers," published by the Royal Society of London. In other cases the numbers are only provisional, and are printed in italics.

The references are made as follows: the name of the author is given first, unless the author has been indicated already; then follows the letter or the number by which the title of the work or paper is designated upon the list; if a Roman numeral is given it denotes the number of the volume; and the last number is that of the page. The system of references to a List was followed by me in 1872, in the paper entitled Intermembral Homologies (10), and has been since adopted by others.

may be led to treat certain topics according to the special opportunities which they may enjoy, and that thus, eventually, there may be available for workers in Human, Veterinary and Comparative Anatomy, a complete account of the Gross Anatomy, the Histology, the Development, the Functions, and the Taxonomic Relations of the brain of a common mammal.

That the domestic cat is not only common in most civilized lands, but otherwise well adapted to serve as the basis for work upon other forms, including man, has been urged by Straus-Durckheim (A. pp. xiv and 54), H. S. Williams (A, iii), Mivart (B, ix), and the writer (*2*).

Subsequent experience has abundantly confirmed the views expressed in the paper last named, and has even removed my previous somewhat unfavorable impression respecting the availability of the cat for physiological experimentation.*

That the idea of employing the cat as an introduction to the study of other forms is neither original nor of recent adoption, may be seen from the work of Straus-Durckheim, and from the following passages in my papers :—

"Nearly twenty years ago†, the late Professor Jeffries Wyman, in commenting upon the unsatisfactory nature of some notes of dissections, said : 'Much of this is due to the lack of suitable standards for comparison. The human body is not a suitable standard for the lower vertebrates. The best thing any anatomist can do is to prepare complete accounts of the structure of a few forms, each typical of some large group. The fowl could represent the birds, and the cat the mammals. The cat's anatomy should be done first, because it would serve as an introduction to human anatomy, and thus become an important aid to medical education.'" Wilder, *2*, 5.

Eight years ago, in a paper (11) upon the outer cerebral fissures of certain mammals, I offered the following suggestion :—

"But before any final work can be done in respect to fissures, we need a complete account of the brain of some one mammal, giving its appearance from all sides, sections and dissections of all parts, and demonstrations of the relations which may exist between the fissural pattern and the internal structure; then a full series of figures representing all the stages of development, both of the brain as a whole, and of its parts. On some accounts the fox would be the most useful species, but as it is not to be had in large numbers, and as dogs are ineligible as a standard, from the breed differences as well as from the usual complexity of the fissural pattern, we shall probably find the cat most available for the purpose. Such a work would form a fitting continuation of Straus-Durckheim's magnificent monograph of the Osteology and Myology of that animal. It

*The fiercest cat, provided it can once be induced to enter a bag, is managed almost as easily as a rabbit. Ether and chloroform act quickly and surely, and I have never encountered any serious difficulties, whether in the laboratory or lecture-room, in performing the experiments commonly employed for physiological illustration. Of course, these experiments were all *callisections*, that is, done by the aid of anæsthetics. In my opinion, as elsewhere expressed (*10*), *sentisection* or painful vivisection is rarely necessary or justifiable.

† It was in 1860, now twenty-one years ago.

is one of the tasks which I wish to accomplish, but I trust this will not deter others from undertaking it."

Since the above was written, I have lost no opportunity of accumulating materials for the illustration of the encephalic anatomy of the cat, and the museum of Cornell University now contains more than 220 preparations of the brain of that animal. A few of these are the entire organ, or its undissected halves; the larger number are dissections for the sake of showing certain points in its structure.

At the outset, I hoped to find that, excepting purely histological matters, the structure of the human brain was so fully known as to require little more than the identification and description of the corresponding features in the cat. It was soon apparent, however, that some points of considerable morphological importance were as yet undetermined, or at least presented very unsatisfactorily in the standard works. To the deficiencies or positive errors of the published accounts, was added the difficulty of obtaining examples of the human brain in such a condition as to serve for the determination of doubtful points. After considerable observation and enquiry upon the subject, I am constrained to affirm that, by the ordinary method of extraction, the freshest human brain is so distorted as to be useless excepting for the roughest kind of enquiry, while the average dissecting-room brain is often only fit to be examined with a spoon.

Theoretically, of course, the anatomy of the human brain is to be learned only by the examination of that organ. Practically, however, so great are the difficulties of obtaining, preserving, and dissecting it, that, with most persons, a certain expenditure of time and money upon cats' brains will be more productive than if devoted to the brains of human beings.*

After spending more than twenty years in the study and teaching of anatomy and physiology, aided by the best models and plates, I feel that nearly all my real and substantial knowledge of the brain has been derived from that of the cat. Nor has the time yet come when I can examine a cat's brain for an hour, without correcting some misapprehension, learning something new, or at least gaining some fresh conception respecting the organization or functions of the organ, or its possibilities in the way of variation.

The present paper concerns only the *gross anatomy* of the brain, and even that is treated in only a general way. I fully recognize the great, perhaps the paramount, importance of a complete account of the *histology* of the organ, if only as a basis for the physiological, pathological and

*I have expressed elsewhere (2) the belief that, of all the more easily accessible animals, the cat offers superior advantages for preliminary anatomical work, but of course a large amount of information may be gained from the dissection of any mammal, aside from the mere skill in the use of instruments which comes from their actual employment upon the organs. Hence the following quotation from Solly (A, 93) is given with entire approval:—

"I am sure that whoever will take the trouble to go over this dissection [of the rabbit's brain] once or twice before attempting that of the human brain, will find his path much facilitated by the knowledge and the manual dexterity he will have acquired."

psychological observations which are constantly making in all parts of the world. But, with all deference to the presumed views of the many and indefatigable workers in this finer field, I hold that the more urgent need is for a provisional, at least, *identification and nomenclature of the visible parts.*

I am loth to believe that the authors of some histological contributions are not altogether clear upon the position and relations of the parts concerned; but I apprehend that many readers of such contributions fail to appreciate their excellencies or to recognize their defects from the lack of an adequate familiarity with the gross anatomy of the brain; a lack which seems almost unavoidable so long as the chief dependence is placed upon the text-books, or upon the appearances presented by human brains in the condition in which they commonly find their way to the dissecting-table.

Had a recent writer employed the fresh or well-preserved brain of a cat in place of the (presumably) distorted and semi-decomposed human organ, he never could have published a paper "De la non-existence des trous de Monro;" nor, indeed, does the acceptance of a paper with such a reactionary title indicate that the editors of "Progrès Médicale, Nos. 25, 26," have left the beaten track in this respect.

Whoever will carefully examine the fresh or well-preserved brains of cats need not, unless he prefer to accept authority in place of the evidence of his eyes, either doubt the existence of the "Foramina of Monro," or believe that these openings are primarily for the "transmission of the choroid plexus." Neither need he believe that "the third ventricle communicates with the fifth" in any animal, or at any period of development; that "the great transverse fissure" is a real cleft from the outside of the brain into its "ventricular cavities;" that the "corpora quadrigemina, pineal body, corpora geniculata and thalami are internal parts of the cerebrum;" or that, in the cat at least, the thalami enter, in the slightest degree, into the formation of "the floor of the lateral ventricles."

With the view of aiding in the correction of some of such current misapprehensions, and paving the way for more sound and enduring work in other directions, the present paper is purely morphological, and all teleological considerations have been excluded.

Moreover, as has been said already, only a general view of the organ is here given. Each part of the brain requires more or less extended monographic treatment. Not only should its average or usual form, structure, and connections be determined, but its variations should be noted, and correlated with known differences in respect to the age, sex, breed, color and disposition. Anomalies also should be recorded. Of course, such striking cases as the absence of the callosum, reported by the writer in 1879 (*13*) would be at once remarked; but in many other respects we are as yet unaware what is the real normal condition, and are hence unable to determine the extent of departure therefrom. The small size of the cat's brain and the ease with which large numbers may be obtained and preserved, render it peculiarly adapted for this line of enquiry.

It is generally admitted that the brain might be of use in the determination of zoölogical affinities. That it is really so seldom employed for this purpose, excepting as furnishing merely corroboratory evidence, is largely due to the vagueness of our information, which prevents exact comparisons. Now the Carnivora in general, and the Felidæ in particular, form very compact and well-defined groups; hence the careful comparison of the parts of the cat's brain with the homologous parts in other members of the family and order should not only be comparatively easy, but also afford some clues to the functions of the parts, as well as furnish a basis for taxonomic considerations.

It would probably be difficult to estimate the influence, upon both physiology and systematic zoölogy, of the sum of knowledge which may be available when the brain has received an amount of time, labor and thought equal to that which has been devoted to the skull.

Considering the abundance of the domestic cat in most parts of the world where anatomy is cultivated, very little use seems to have been made of its brain. In several papers (Owen, 35), Krueg (*2*), Benedikt (*1* and *2*), Pansch (*1*), the cerebral fissures are more or less fully discussed; but I am not acquainted with any special paper on the entire organ, and the only figures of the structure known to me are the following: The mesal surface is shown by Leuret et Gratiolet (A, pl. v, fig. 3); the procœliæ (ventriculi laterales) are shown by Gegenbaur (A, 508, fig. 286); and the dorsal and ventral surfaces are partly seen in connection with the nerves in Bourgery and Jacob (A, pl. xvi).

The sheep's brain seems to have been selected by Foster and Langley (A), and by Morrell (A), partly, at least, on account of the ease with which the head may be procured, thus avoiding the killing of an animal for the sake of the brain. But cats are so plenty, and so readily killed by chloroform, that no objection need exist upon that score, and the brain is removed, preserved and dissected much more conveniently than that of the sheep.*

The small size of some of the parts of the cat's brain is an objection, no doubt; but this is atoned for by the number of preparations one may make and keep, and by the ease with which the entire organ may be held or placed in any position so as to obtain the best light without the danger—which is ever present with larger brains—of tearing by its own weight.

B. THE MACROSCOPIC VOCABULARY OF THE BRAIN.

In a recent paper (*9*), I have presented somewhat in detail both the grounds for attempting a Revision of Anatomical Nomenclature, and the results of that revision.

With a slight rearrangement, and some unimportant verbal alterations, the following paragraphs remain as there published (pp. 123, 137), and

*For a detailed account of the methods of preparing the cat's brain, see my paper in 'Science" (*11*).

embody a brief statement of "the objects of the present revision, the considerations upon which it is based, and the methods which have been pursued :"

"To facilitate the acquisition and communication of accurate anatomical knowledge, by rendering the vocabulary equally applicable to all vertebrates, and equally intelligible to all nations.

"That the convenience and preferences of all existing anatomists should be held of little moment as compared with the advantages which reform may ensure to the vastly more numerous anatomical workers of the future.

"That the test of the accuracy and completeness of a description is, not that it may assist, but that it cannot mislead.

"That *brevity* is an especially desirable characteristic of such names as are most frequently employed.

"To include in this vocabulary, so far as practicable, only such terms as are brief, simple, significant, of classical origin and capable of inflection.

"To propose as few changes as possible, and to introduce new names only for parts apparently unknown or unnamed before (*e. g., crista fornicis*), or in the place of semi-descriptive appellations undesirably long or incapable of inflection, as *e. g., cimbia* for *tractus transversus pedunculi, porta* for *foramen Monroi.*

"When a part is known by a descriptive phrase, to select therefrom some characteristic word as the technical designation ; *e. g., iter* (*a tertio ad ventriculum quartum*).

"When two or more parts are similar, or have similar relations, to distinguish them by joining to some common title already in use prefixes indicative of their relative positions ; *e. g., postgeniculatum, prægeniculatum.*

"To shorten the names of several parts by omitting the word *corpus,* and using the neuter adjective as a substantive.

"To discard terms which indicate *size,* those which refer to the *natural attitude* of man or animals, most *vernacular* names, and all names of the reproductive organs which have been applied needlessly to other parts of the body.

"To keep modern usage, and the rules of classical etymology constantly in mind, but not to be hindered thereby from the employment or even the formation of terms which are eminently desirable from the practical standpoint."

At my request, the publisher of "Science" kindly sent copies of the two numbers containing the article to leading scientific, medical and literary journals, and to about 22 naturalists or physicians who make more or less use of anatomical terms in their writings. There has been scarcely time for any extended criticism of the proposed changes, but as the article contained a very distinct request for suggestions, I am disposed to infer that anatomists are at least willing to let the new terms have a fair trial in the present paper, the preparation of which was announced at the head of the article.

The following are the only published comments upon the subject, which have come to my notice :—*

In *The Nation* for April 12, 1881, is a brief notice of the article, evidently

* Since this was written, The Journal of Nervous and Mental Disease for July, 1881 (652-661), has reprinted from the paper (*9*) the List of names of encephalic parts, and regards the new nomenclature as supported by "rather satisfactory arguments." See also p. 562 of this paper.

by an anatomical teacher, from which I quote the following: "There is certainly ample room for it [the reform proposed], but one cannot help thinking that in his desire for set names, Professor Wilder approaches pedantry." In view of what might have been expected from so critical a journal, I am disposed to feel more encouraged by the admission than disheartened by the objection.

Dr. Oliver Wendell Holmes wrote me the following letter upon the subject, which, with his permission, was printed in "Science" for June 4, and is here, in part, reproduced:—

BOSTON, May 30, 1881.

DEAR DR. WILDER:—I have read carefully your paper on Nomenclature. I entirely approve of it as an attempt—an attempt which I hope will be partially successful, for no such sweeping change is, I think, ever adopted as a whole. But I am struck with the reasonableness of the system of changes you propose, and the fitness of many of the special terms you have suggested.

The last thing an old teacher wants is, as you know full well, a new set of names for a familiar set of objects. It is hard teaching old professors new tricks. So my approbation of your attempt is a *sic vos non vobis* case so far as I am concerned. * * *

What you have to do is to keep agitating the subject, to go on training your students to the new terms—some of which you or others will doubtless see reasons for changing—to improve as far as possible, fill up blanks, perhaps get up a small Manual in which the new terms shall be practically applied, and have faith that sooner or later the best part of your innovations will find their way into scientific use.

* * * The plan is an excellent one—it is a new garment which will fit Science well, if that capricious and fantastic and old-fashioned-dressing lady can only be induced to try it on.

Always very truly yours,

O. W. HOLMES.

Dr. Holmes's literary authority, as well as the fact, perhaps less generally known, that for 33 years he has been the Professor of Anatomy in the Medical School of Harvard University, will give great weight to his approbation of my undertaking.

In Science for April 29, 1881, Dr. E. C. Spitzka of New York, well-known as an indefatigable worker in encephalic anatomy and histology, published (7) a letter to the Editor respecting my article. Dr. Spitzka generously puts aside the natural feeling of disappointment that a task which he had contemplated for several years should be, however imperfectly, performed by another, and, together with valuable practicable suggestions upon several important points, comments as follows upon the general subject:—

"It is with mingled pleasure and profit that I have read the very suggestive paper on Cerebral Nomenclature contributed to your latest issues by Prof. Wilder. Some of the suggestions which he has made have been

latent in my own mind for years, but I have lacked the courage to bring them before my colleagues. Now that he has broken ground, those who prefer a rational nomenclature to one which like the *present* reigning one, is based upon erroneous principles, or rather on no principles at all, will be rejoiced at the precedent thus set for innovations. As Prof. Wilder has invited criticism, I take the opportunity of offering the following remarks upon the leading points of his papers, in so far as they refer to the brain alone.

"1. The principles announced are such as zoötomists and anatomists generally will agree with, to the fullest extent. * * * I have no hesitation in saying that the labor of the anatomical student will be diminished fully one-half when this nomenclature shall have been definitely adopted. * * * In Germany the older system has gone out of use almost entirely, and not the least charm about the works of Henle, Schwalbe, Forel and Gudden, is the fact that these authors have more or less done away with the ambiguous terms once rampant.

"3. In proceeding to comment on some of the terms proposed by Prof. Wilder, I wish it to be distinctly understood that I do so merely tentatively and to promote discussion; in so doing I feel certain that I am carrying out that writer's wish. It is but just to state that the majority of the terms cannot be discussed—they are perfection and simplicity combined."

I think Dr. Spitzka does himself scant justice in ascribing his non-presentation of the subject to "a lack of courage." But I can well understand that the demands of an active practice have forced him to defer from time to time the somewhat onerous task of putting his material into shape for publication.*

In the following discussion of the macroscopic vocabulary of the brain, I have transcribed freely from the article above named, introducing such modifications as have since appeared to me desirable.

The terms employed by anatomists form two divisions: those which indicate the *position* or *direction* of organs, and those by which the organs themselves are designated. Since, also, writers have usually treated of them separately, it will be convenient here to consider anatomical *toponomy* and *organonomy* under distinct headings.

Terms of Position and Direction—Toponomy.

Dr. Barclay's volume had especial reference to this division of the subject, and its key-note is struck in the following paragraph (A, 5):

"The vague ambiguity of such terms as superior, inferior, anterior, posterior, &c., must have been felt and acknowledged by every person the least versant with anatomical description."

Dunglison admits (A, 61) that "Great confusion has prevailed with anatomists in the use of the terms before, behind, &c." Dr. Spitzka has forcibly stated (*1*, 75, note 1) the objections to the use of anterior, &c., and their unsuitability is tacitly conceded in the employment of other terms by

*Since this paper was presented, Dr. Spitzka has published an able contribution (*10*) to our knowledge of the metencephalon, in which the toponomical terms herein suggested are employed.

several writers who do not explicitly condemn the current toponomy: Gegenbaur (A, 491), Mivart (A, 69), Cleland (*l*, 170), Rolleston (B, 33, note), &c.

Finally, the need of a radical change of base has been proclaimed in one of the very strongholds of anthropotomy:—

"Now that the more extended study of comparative anatomy and embryonic development is largely applied to the elucidation of the human structure, it is very desirable that descriptive terms should be sought which may, without ambiguity, indicate position and relation in the organism at once in man and animals. Such terms as cephalic and caudal, dorsal and ventral, &c., are of this kind, and ought, whenever this may be done consistently with sufficient clearness of description, to take the place of those which are only applicable to the peculiar attitude of the human body."—Quain, A, I, 6.

This is certainly explicit as to the principle involved, and it is to be hoped that later editions of this standard Human Anatomy may display its practical application to the body of the work.

How slender is the justification for retaining a toponomical vocabulary based upon the relations of organisms to the surface of the earth, appears more fully when we reflect that the assumed standard, for the higher vertebrates at least, is man in his natural erect attitude; yet that both man and animals are more often examined and compared with the *back downward*, this being an attitude truly characteristic of only that infrequent "subject," the sloth.

As a single illustration of the logical inconsistencies into which we are led by the use of the current toponomy, take the series of possible designations of the direction of some vertebral spinous process which projects toward the skin of the back at, or approximately at, a right angle with the myelon. With man the direction in which it points is *posterior*, but with a cat it is *superior*, while with an ape or a bird it is somewhere between the two; with all four, when on the dissecting table, it would be usually *inferior*. Finally, with a flounder the corresponding direction would be *horizontal* or *sidewise*.

In short, to designate the locations of organs by the relations of animals to the surface of the earth, which relation differs in nearly allied forms, and varies with the same individual according to circumstances, is as far from philosophical as it would be to define the place of a house or a tree by reference to the planet Jupiter, or to assume that mankind naturally face the rising sun, and hence to designate our right and left as the south and north sides of the body.

The present tendency of accurate anatomical description is to refer the position or direction of all parts and organs to an imaginary plane dividing the body into approximately equal right and left halves; hence it is desirable to designate this middle plane, or any line contained therein, by a word which is at once significant, short, and capable of inflection. Dr. Barclay proposed *mesion*, and *mesial* has been generally used; but would

it not better to adopt the very term employed by the Greeks to signify the middle, *meson*, *τό μέσον*, equivalent to the more ponderous Latin *meditullium?* The corresponding adjective is *mesal*, and the adverb *mesad*, while in combination it becomes *meso*.

The following general terms were also proposed by Barclay, and have been more or less systematically employed by Owen, Huxley and others: *Dorsal*, *ventral*, *dextral*, *sinistral*, *lateral*, with the corresponding adverbial forms *dorsad*,* etc. Should the alleged correspondence of the ventral region of the Vertebrate with the tergal region of the Arthropod prove to be one of true homology, it may be desirable in time to discard *dorsal* and *ventral* for more suitable terms, but for the present, if on practical grounds alone, it seems well to retain them.

Barclay proposed *atlantal* and *sacral* for the designation of the position of parts lying toward the head or the tail, in reference to an imaginary plane dividing the trunk at the middle of its length. But these terms were not applicable to parts beyond the atlas and the sacrum, so that new words were applied to the regions of the head. Perhaps this needless complication has hindered the general adoption of Barclay's nomenclature nothwithstanding its many admirable features. At any rate, *cephalic* and *caudal* are much more acceptable terms, and are practically unobjectionable, although certain theoretical difficulties readily suggest themselves.

Proximal and *distal*, *central* and *peripheral* are in common use, and the general employment of their inflections and derivatives is only a question of time. *Proximal* and *distal* seem to be more applicable to the limbs and their segments, while *central* and *peripheral* may be employed for vessels and nerves.

Ental, and *ectal* were proposed (*9*) as substitutes for the more or less ambiguous words *inner* and *outer*, *interior* and *exterior*, *deep* and *superficial*, *profound* and *sublime*. Derived respectively from *ἔντός* and *ἐκτός* their significance is obvious, while their brevity and capacity for inflection will probably commend them to accurate working anatomists.

The Names of the Parts—Organonomy.

Abbreviations of the more general names of encephalic parts.

Ar.—Area.	F.—Fissura.	Px.—Plexus.
C.—Cœlia.	Fm.—Foramen.	R.—Recessus.
Clm.—Columna.	Fn.—Funiculus (root-let).	Rx.—Radix.
Cn.—Canalis.	Fs.—Fossa.	Sl.—Sulcus.
Cp.—Corpus.	Inc.—Incisura.	Spt.—Septum.
Cr.—Crus.	L.—Lobus.	T.—Tuber.
Crs.—Crista.	Ll.—Lobulus.	Tr.—Tractus.
Cs.—Commissura.	Pt.—Portio.	Tl.—Tela.
Em.—Eminentia.		

*In his recent paper (*2*) on the Evolution of Mammals, as printed in "Nature," Jan. 6, 1881, p. 228, Huxley uses the term *dorsad*.

ABRIDGED SYNONYMY OF THE CEREBRAL FISSURES.

Abbrev.	*Flower*, 1869, 28. *Leuret*, 1839, A. *Huxley*, 1861, 70; 1872, A.	*Owen*, 1868, A.	*Wilder*, 1873, 10.	*Krueg*, 1880, 2.	*Adopted in the present paper.*	
a.		Ant. branch of ectosylvian	Ant. upright of ectoslyvian	Anterior.	Anterior.	a.
an				Ansata.	Ansata.	an.
cf.		Part of medilateral.	Part of medilateral.	Confinis	Confinis.	cf.
cl.		Callosal.			Callosalis.	cl.
cor.		Coronal.	Coronal	Coronalis.	Coronalis.	cor.
cr.	Crucial	Frontal.	Frontal	Cruciata	Cruciata.	cr.
dg.				Diagonalis.	Diagonalis	dg.
fm.					Fimbriæ.	fm.
fl.		Part of falcial.		Genualis	Falcialis	fl.
hmp.	Hippocampal. Dentate, *Huxley*, 1861.	Hippocampal.		Hippocampi.	Hypocampæ	hmp.
in					Intermedia	in.
l.		Lateral	Lateral.	Lateralis.	Lateralis	l.
ln					Lunata	ln.
ml.		Part of medilateral	Part of medilateral.	Medilateralis	Medilateralis.	ml.
mr.		Marginal.		Suprasplenialis	Marginalis	mr.
ol.			Ectorhinal.	Olfactoria.	Olfactoria.	ol.
p.		Post. branch of ectosylvian	Post. upright of ectosylvian.	Postica.	Postica.	p.
per.				Posterruciata.	Posterruciata	per.
pmr				Postsplenialis	Postmarginalis.	pmr.
prd					Postradicalis.	prd.
prh.		Part of ectorhinal	Part of rhinal.	Rhinalis posterior.	Postrhinalis	prh.
prrd					Præradicalis.	prrd.
ps		Postsylvian.	Part of supersylvian	Suprasylvian poster-	Postsylviana.	ps.
rh		Part of ectorhinal	Part of rhinal	Rhinalis. [ior.	Rhinalis	rh.
s	Sylvian	Sylvian.	Sylvian.	Sylvii.	Sylviana	s.
sfl		Part of falcial		Rostralis.	Subfalcialis.	sfl.
sp	Callosomarginalis (Flow. and Huxley).	Supercallosal.		Splenialis	Splenialis.	sp.
so	Supraorbital (Flow.).		Presylvian.	Præsylvii.	Superorbitalis	so.
ss.		Supersylvian.	Postsylvian & supersylvian.	Suprasylvii	Supersylviana.	ss.

Abbreviations of the Cranial Nerves. (See fig. 3.)

For convenient comparison, the numerals applied by Sœmmering are prefixed to the proper abbreviations.

vi. *abd.*—Abducens.
xi. *ac.*—Accessorius (spinalis).
viii. *au.*—Auditorius. (Portio mollis.)
vii. *f.*—Facialis. (Portio dura.)
ix. *gph.*—Glossopharyngeus.
xii. *hg.*—Hypoglossus.
iii. *ocm.*—Oculomotorius. Motor communis.
i. *ol.*—Olfactorius.
ii. *op.*—Opticus.
iv. *tr.*—Trochlearis. "Patheticus."
v. *trg.*—Trigeminus. Trifacialis.
x. *v.*—Vagus. Pneumogastricus. Par vagum.

List of the Parts of the Cat's Brain which are Visible to the Unaided Eye.

To avoid repetition, this list is accompanied by the abbreviations which are used upon the plates, and, for convenience of reference, the names are arranged in the alphabetical order of the abbreviations. Only the abbreviations of *general* names are capitalized. The numbers following the names indicate the figures upon which the parts are shown, or, in a few cases, the pages on which they are mentioned.

Most of the names are those in common use, with the omission of superfluous elements like *corpus*, and the genitives of the names of more comprehensive parts. Most of the apparently new names will be found to be old acquaintances under such thin disguises as *translation*, *transposition*, *abridgment*, and the *substitution of prefixes* for qualifying words. In a few cases the old names, are wholly discarded for briefer new ones. Most of the new names, however, refer to parts apparently unobserved hitherto (*e. g.*, *crista*, *carina*, *delta*), or to parts which—although probably observed—seem not to have been regarded as needing a special designation (*e. g.*, *aula*, *quadrans*, *pero*).

So much of each name as immediately follows the abbreviation, is regarded as a sufficient designation of the part under ordinary circumstances; sometimes it may be desirable to add the words in parenthesis.

a.—Aula. The cavity of the primitive prosencephalon, or Lobus communis. 3, 13, 16. See p. 540.
abn.—Albicans (Corpus). 3, 4, 11.
alb.—Alba (Substantia). White matter. 13, 14, 20.
apx.—Auliplexus. Not distinctly shown. See p. 542.
arb. vt.—Arbor vitæ (cerebelli). 4.
Ar. cr.—Area cruralis. 3, 11.
Ar. icr.—Area intercruralis. 3, 11.
Ar. el.—Area elliptica. 3.

Ar. ov.—Area ovalis. 3.
Ar. ppn.—Area postpontilis. 3.
Ar. prch.—Area præchiasmatica. 3.
Ar. spt.—Area septalis. 4, 16.

ca.—Carina (fornicis). Not shown, see p. 556.
cb. or *hem.*—Cerebrum; prosencephalon; hemisphæræ. 1, 2, etc.
cbl.—Cerebellum. 1, 2, 12, 15.
cd. s.—Cauda striati. See p. 542.
cel. m.—Cella media (procœliæ). 15.
ch.—Chiasma (NN. opticorum). 3, 4, 5, 11, 16.
cin.—Cinerea (Substantia). Gray matter. 14, 20.
cl.—Callosum (Corpus). 4, 13, 15, 16, 17, 20.
clc.—Calcar. Hippocampus minor. Not in the cat.
clv.—Clava. 12.
Clm. d.—Columna dorsalis myelonis. Posterior white column of the spinal cord. 1.
Clm. f.—Columna fornicis. 4, 10, 13, 14, 16.
Clm. l.—Clm. lateralis myelonis. 1, 3.
Clm. v.—Clm. ventralis myelonis. 3.
cmb.—Cimbia. Tractus transversus pedunculi. 3, 8, 9, 11.
cn.—Conarium. Corpus pineale. 7, 10. See p. 562.
Cn. ce.—Canalis centralis (myelonis). 4.
Cr. cb.—Crus cerebri. 2, 4, 9, 11, 18, 19.
Cr. ol.—Crus olfactorium. 4, 5.
Crs. f.—Crista (fornicis). 4, 14, 16, 20. (See Wilder, 7.)
Cs. f.—Commissura fornicis. 14.
Cs. h.—Commissura habenarum. 4, 6.

d.—Dura (mater). Not shown.
dc.—Diacœlia. Ventriculus tertius. 4, 6, 7, 16. See p. 539.
den.—Diencephalon, interbrain. 7, 9, 10.
dlt.—Delta (fornicis). 10, 14.
dpx.—Diaplexus. Plexus choroideus ventriculi tertii.—4, 16.
dtl.—Diatela. Roof of diacœlia.

Em. au.—Eminentia auditoria. 2, 3.
end.—Endyma ependyma. The lining membrane of the cœliæ.
epc.—Epicœlia. Ventriculus cerebelli. 4.
epen.—Epencephalon. Hind brain. 4.
f.—Fornix. 14, 15, 16, 17, 19, 20.
F.—Fissura. See list of cerebral fissures, p. 534.
F. dl.—Fissura dorsilateralis (myelonis). Postero-lateral fissure of the spinal cord. 1.
F. dms.—Fissura dorsimesalis (myelonis). 1.
F. vl.—F. ventrilateralis (myelonis). 3.
F. vms.—F. ventrimesalis (myelonis). 3.
Fm. cc.—Foramen cæcum. 3.

Fm. cn.—Foramen conarii. 6.
Fm. inf.—Foramen infundibuli. 6.
fmb.—Fimbria. Corpus fimbriatum. 14, 17.
fscl.—Fasciola. Fascia dentata and fasciola. 14, 17.
g.—Genu (callosi). 4, 17.
h.—Habena. Habenula ; pedunculus pinealis. 4, 7, 16.
hem.—Hæmisphæra. Hemicerebrum. 1, 2, 3, 4, etc.
hmp.—Hypocampa. Hippocampus major. 14, 15, 18, 19.
hph.—Hypophysis. Corpus pituitarium. 3, 4. See p. 562.
Inc. hmp.—Incisura hypocampæ. 11.
inf.—Infundibulum. 3.
ins.—Insula. Island of Reil. Not distinct in the cat. See p. 543.
it.—Iter (a tertio ad quartum ventriculum). Mesocœlia, *msc.* 4, 8.
L. l.—Lobus lateralis (cerebelli). 1, 2, 15.
L. ol.—Lobus olfactorius. 1, 2, 15, 17, 18.
L. tmp.—Lobus temporalis (hemisphæræ). 2.
Ll. ap.—Lobulus appendicularis (cerebelli). 2, 3.
Ll. hmp.—Lobulus hypocampæ. Ll. mastoideus. 2, 14, 17.
lm. alb.—Limes alba (radicis lateralis cruris olfactorii). 2, 5.
lm. cin.—Limes cinerea. 2, 5.
lq. c.—Liquor cœliarum. Liquor ventriculi.
ly.—Lyra (fornicis). Psalterium. 14. See p. 543.
mcs.—Medicommissura. Commissura mollis. 4, 16.
mcu.—Medicornu (procœliæ). Cornu temporale. Cornu descendens. 11, 14, 18, 19.
mpd.—Medipedunculus (cerebelli). Crus ad pontem. 8.
msc.—Mesocœlia. Iter. Ventriculus loborum opticorum mesalis. 4, 8.
msen.—Mesencephalon. Midbrain. Lobi optici, etc. 7, 9.
mtc.—Metacœlia. Ventriculus quartus, less the epicœlia. 4.
mten.—Metencephalon. Medulla oblongata. After-brain. 1, 2, 4, 12.
mtpx.—Metaplexus. Plexus choroideus medullæ. 3, 12.
mttl.—Metatela. Roof of metacœlia. 4, 12.
my.—Myelon. Spinal cord. 1, 2.
ob.—Obex. Not identified in the cat.
olv.—Oliva. Corpus olivarium. Not identified in the cat.
op.—Opticus (Lobus). Cephalic optic lobe; natis cerebri. 4, 7, 9, 18, 19.
p.—Porta (Monroi). Foramen Monroi. 14, 16, 18, 19. See p. 540.
pi.—Pia (mater). Not shown. See p. 543.
pcs.—Postcommissura. Commissura posterior. 4.
pgn.—Postgeniculatum, (Corpus). Corpus geniculatum internum. 7, 8, 9, 10.
po. ol.—Pero olfactorius. 16.
pop.—Postopticus (Lobus). Caudal optic lobe ; testis cerebri. 4, 7, 8, 9, 18, 19.

pn.—Pons (Varolii). 2, 3, 4, 9, 11.
ppf.—Postperforatus (Locus). 3, 4, 11.
ppx.—portiplexus. 18.
prc.—Procœlia. Cœlia prosencephali; ventriculus lateralis. 15, 16, 18, 19.
prcs.—Præcommisura. Commissura anterior. 4, 14, 16.
prcu.—Præcornu (procœliæ). Cornu anterius. 13, 15, 16, 18, 19.
pren.—Prosencephalon. Cerebrum. Hemisphæræ.
prgn.—Prægeniculatum. Corpus geniculatum externum. 7, 8, 9.
prpf.—Præperforatus, (Locus). Locus perforatus anterior. 3, 4, 11.
prpx.—Proplexus. Plexus procœliæ. 15, 18.
ps. ol.—Pes olfactorius. 16.
Pt. d.—Portio depressa (præperforati). 3, 11.
Pt. dien.—Portio diencephalica (cruris cerebri). 11.
Pt. msen.—Portio mesencephalica (cruris cerebri). 11.
Pt. p.—Portio prominens (præperforati). 3, 4, 11.
py.—Pyramis (metencephali). Pyramis anterior. 3, 4.
psc.—Pseudocœlia. Ventriculus septi lucidi; fifth ventricle. Not in the cat. See p. 549.
q.—Quadrans (cruris.) 11.

r.—Rima. Fissure of Bichat. 14, 17.
R. a.—Recessus aulæ. 14.
R. op.—Recessus opticus. 4, 11, 16.
R. prpn.—Recessus præpontilis. 4.
Rg. a.—Regio aulica. The complex region about the aula.
rhc.—Rhinocœlia. Ventriculus olfactorius. 16.
rhen.—Rhinencephalon. Lobi olfactorii. 1, etc.
rm.—Rostrum (callosi). 4.
rp.—Ripa. 14.
Rx. in.—(Cruris olfactorii). Not distinct in the cat. See p. 548.
Rx. l.—Radix lateralis. 3.
Rx. mt.—Radix motoria (Nervi trigemini). 3.
Rx. ms.—Radix mesalis (Cruris olfactorii). 3.
Rx. sn.—Radix sensoria (Nervi trigemini). 3.

s.—Striatum (Corpus). 13, 15, 16.
Sl. h.—Sulcus habenæ. 7.
Sl. ic. l.—Sulcus intercruralis lateralis. 11.
Sl. ic. ms.—Sulcus intercruralis mesalis. 11.
Sl. li.—Sulcus limitans. 13.
Sl. trd.—Sulcus triradiatus. 11.
sp.—Splenium (callosi). 4, 6, 14, 17.
Spt. lu.—Septum lucidum. 16, 19.

t.—Terma. Lamina terminalis. 4, 16. See pp. 541, 544.
T. cin.—Tuber cinereum. 3, 4, 11.
th.—Thalamus (Nervorum opticorum). 7, 9, 10, 13.

Tr. op.—Tractus opticus. 3, 11, 14, 19.
Tr. prh.—Tractus postrhinalis. 3.
tz.—Trapezium. 2, 3.

vl.—Velum (interpositum). Not shown. See p. 544.
vm.—Vermis (cerebelli). 1, 2, 15.
vv.—Valvula (cerebelli). 4.

A few of the terms included in the foregoing list need more extended mention.

The encephalic segments.—It is often convenient, and always more philosophical, to regard the brain as composed of a series of *segments* or *divisions*, each consisting of a cavity, with its sides, floor, and roof variously thickened, convoluted, or otherwise modified. So far as is known, the anatomical divisions most conveniently made correspond essentially with the series of embryonic vesicles.

To these divisions, the German anatomists, following, I believe, Von Baer, apply the names *vorderhirn*, *zwischenhirn*, *mittelhirn*, *hinterhirn*, and *nachhirn*, which are commonly rendered in English by *forebrain*, *'tween-brain*, *midbrain*, *hindbrain*, and *afterbrain*.

In converting these vernacular terms into technical, anatomists have generally recognized the practical advantage of regarding the *Lobi olfactorii* as a segment apart from the cerebral hemispheres, under the name of *rhinencephalon*. The hemispheres, including the *striati*, etc., constitute the *prosencephalon*, and the *Lobi optici*, with the corresponding portion of the *Crura cerebri*, form the *mesencephalon*. So far, all agree. But the region including the thalami, between the prosen. and the mesen. has been variously called *deutencephalon*, *thalamencephalon*, and *diencephalon*. Unable to ascertain which has priority, I select the last as the shortest and most applicable.

Upon the names of the remaining parts of the brain there is more serious divergence of usage among writers. Owen (A, I, 293) calls it all *epencephalon*; but Huxley applies (A, 60) that name to the pons and cerebellum as a division separate from the medulla, which he calls *myelencephalon*, notwithstanding this term had been previously proposed by Owen (A, I, 268) for the entire "cerebro-spinal axis." In this, Huxley is followed by the English editor of "Gegenbaur" (A, xiii) notwithstanding his admission that a different nomenclature had been previously published in Quain (A, II, 755). The editors of "Quain" recognize the two divisions, and apply *epencephalon* to the pons and cerebellum, giving to the medulla proper the name *metencephalon*. On all accounts, this seems to me the best arrangement of terms for the encephalic segments, and is followed in the present paper.

The cœlia, or encephalic "ventricles."—The incongruity of the anthropotomical designations of the encephalic cavities has been pointed out by Owen (A, I, 294, note), and the writer (*9*, 125).

The *canalis centralis* expands into a cavity which, although the first of

the series, is called the *fourth* ventricle. The more or less distinct cavities corresponding to the cerebellum and the Lobi optici are not called ventricles at all, and the *third* is between the thalami. The two "lateral" ventricles are rarely mentioned as the *first* and *second*, but since the numbers must be understood in order to account for the *third* and *fourth*, the student desires, in vain, to know which is the first and which the second. In point of fact, if the enumeration is begun at the cephalic end of the series, the lateral ventricles are the third and fourth, since there are well-developed ventricles in the *Lobi olfactorii*. Finally, a "*fifth* ventricle" is mentioned, which is not only at the greatest distance from the fourth, but has no normal connection with the other ventricles, and is, in fact, no part of the series.

In view of all this, the task of describing to students the highways and by-ways of the brain—which should be most attractive because therein is most clearly manifested the ideal arrangement of the organ—is one from which I shrink as from any other kind of solemn nonsense. To my mind, indeed, rather than go on as we have been going, it would be at once more philosophical and more intelligible to adopt the simple vocal device employed by Straus-Durckheim for the designation of the Ossa metatarsalia—"padion, pedion, pidion, podion, pudion"—and to re-christen the ventricles by, for instance, the names *pran*, *pren*, *prin*, *pron*, and *prun*.

Fortunately, however, another alternative is presented. Assuming that the terms *rhinencephalon*, *prosencephalon*, *diencephalon*, *mesencephalon*, *epencephalon* and *metencephalon* are to be retained, and that they are to be learned by successive generations of students, why should we not transfer the distinctive prefixes to the Greek word for ventricle, *κοιλία*, *cœlia*? This would give us *rhinocœlia*, *procœlia*, *diacœlia*, *mesocœlia*, *epicœlia*, and *metacœlia*.

These terms are capable of inflection, and the longest of them is no longer than the Latin *ventriculus*, which requires a prefix or qualifying word. These prefixes may be also employed for the designation of the membraneous roofs of the "third" and "fourth" ventricles, and the plexuses of these and the lateral ventricles. Thus we should have *metatela* and *metaplexus*, *diatela* and *diaplexus*, *proplexus*, *portiplexus*, and *auliplexus*. Two or more "ventricles" would be spoken of as *cœliæ*, while the "fifth ventricle," which is really no part of the series, may well be called *pseudocœlia*.

Aula.—I hope, before long, to justify more fully the proposition already made (Wilder, 5 and 9), to consider the cephalic portion of the "third ventricle" between the *portæ* (Foramina Monroi), as a morphologically independent cavity under the name of *aula*.

Porta.—This is proposed as a convenient substitute for the phrase "Foramen Monroi." If the two orifices leading, respectively, from the two procœliæ ("lateral ventricles"), into the aula, and so communicating with the entire mesal series of cœliæ, were seldom employed, or even as frequently as "Foramen Magendie," there might be less call for a change of name; but, according to my view of the best method of studying the

brain, these slight orifices, which are but rarely demonstrated, and have never been, so far as I know, accurately figured, have a real and great morphical value, and should be frequently named; hence the desirability of a short term capable of inflection. Since there is no other encephalic *porta*, the single word is sufficient; but *Monroi* may be regarded as belonging thereto, in memory of the description of the parts by A. Monro *secundus* (A). See my paper (*3*).

Medicornu, etc.—In place of the terms *Cornu descendens*, etc., I have suggested that the three prolongations of the procœlia into the *Lobi temporalis*, *frontalis*, and *occipitalis* respectively, should be called *medicornu*, *præcornu*, and *postcornu*. The latter does not exist in the cat.

Rima.—This brief name is proposed as a substitute for the phrase "*rima transversa cerebri magna*," and its various classical or vernacular equivalents. That, in the cat, the connection of the two borders of the rima is complete, and capable of resisting a considerable pressure of air, alcohol or plaster, has been repeatedly demonstrated by me since the 25th of November, 1876. But the proper nervous tissue is interrupted from the dorsal border of the porta to near the tip of the medicornu, and, in so heavy a brain as that of man, the membraneous connections are readily torn during the extraction or manipulation of the organ; see my paper, *9*, 136.

Proterma.—prtr.—The primitive *lamina terminalis* or *l. cinerea*. *Terma embryonis*. My reason for suggesting different terms for the adult and embryonic terminal plates, is that, as now understood, the latter includes not only the *lamina cinerea* of anthropotomy, but also the parts afterward differentiated to form the *Columnæ fornicis*, and the *præcommissura*, with perhaps some other parts of the *fornix*.

Hypocampa.—In the paper on Nomenclature (*9*, 125) I stated that this term is employed by Vicq D'Azyr (A) in the descriptions of the plates, although the more common form *hippocampus* occurs in the "List of anatomical terms," in the same work. At that time, I had only seen the passages in the description of pl. vii, fig. 1 and 3; pl. viii, fig. 2; on p. 61, and elsewhere, where the French form *hypocampe* is used. I have since found several passages, as the descriptions of pl. vi, note, and plate viii, fig. 2, where the Latin forms *hypocampus* and *hypocampi* are given.

Vicq D'Azyr does not discuss the etymology of the term, but says (A, p. 61), the "grande hypocampe" was first mentioned by Arantius and Varolius, whose works are not now accessible to me. Even Hyrtl (A, 180), does not seem aware of the use of the word by Vicq D'Azyr, and all other writers, so far as I know, make it *hippocampus*. There is no such word as *κάμπος*, and, if the original orthography cannot be ascertained, *hypocampa* is to be preferred on etymological grounds; the ridges known as *hippocampus major* and *h. minor* bear no obvious resemblance to the fish known to the ancients as *ἱππόκαμπος* and *hippocampus*, but the larger of the two, which probably first received the name, does certainly present a most notable *downward curvature*, such as the Greeks might have designated by *ὑποκαμπή*.

C. A LIST OF SOME POINTS TO BE ELUCIDATED.

No part of the cat's brain is thoroughly or sufficiently understood, and all parts need monographic treatment. The following points, therefore, are selected because the deficiencies in our knowledge of them have been most distinctly impressed upon me.

Albicans.—alb.—Have the *albicantia* the same relation to the Columnæ fornicis which is said to exist in the human brain? What morphical or telical significance has their degree of separation from one another?

Area elliptica.—Ar. el.—With what does this correspond in man and the lower vertebrates? If it represents the *oliva* or "olivary body," its position is reversed from that in man in relation to the apparent origin of the *N. hypoglossus.*

Area ovalis.—Ar. ov.—With what does it correspond in man and the lower vertebrates? What are its relations to the several columns of the myelon and metencephalon?

Aula.—a.—What are its precise limits? In the cat, and other forms with a large *medicommissura*, this commissure may be regarded as its caudal boundary; but in man, where the commissure is smaller, and in the lower vertebrates where it is wholly absent, the question of limitation is more difficult.

Auliplexus.—apx.—The plexus which appears near the dorsal end of the *aula* on each side. This plexus is continuous, through the *portiplexus*, with the *proplexus*, and apparently also with the diaplexus, but the relations of the latter are doubtful.

As to the plexuses in general, are they formed as stated by Quain (A, II, 545), and other authors, by the intrusion of the free border of the velum, or of processes thereof, still covered by the endyma, into the various cavities, or as recently stated by Mivart (B, 266)?

"The choroid plexuses of the lateral ventricles are (like those of the third) merely portions of the ependyma, which happen to be very vascular, and are not really intrusions from without."

This statement is so positive that, though unsupported by figures, or detailed description, I forbear to affirm the contrary. So far as I can judge, however, the *proplexuses* are intrusions of the pia, while the *diaplexuses* seem to correspond more nearly with the view of Mivart. In the one case, the fold of velum bears to the fold of endyma the same relation which an abdominal viscus bears to the visceral layer of peritoneum; in the other case, the plexus may be compared to a fold of omentum.

Carina (fornicis).—*ca. f.*—How nearly constant is it, and what is its significance?

Cauda (*striati*).—*cd. s.*—Is it distinct in the cat? Has it the relations described in man by Cuvier (B, III, 51), and others, and more recently and fully by Dalton (*1*, 13)?

Spitzka says (7):—

"I have identified this structure in the cat; it does not make as fine a sweep as in man, but is distinct at the roof of the inferior horn and loses

itself, as has long been known in the case of the human brain, near the *Nucleus amygdalæ*. Prof. Wilder's term is the only admissable one, both as being descriptive and on grounds of priority."

Chiasma.—ch.—How complete is the decussation? Of course, microscopic sections must be made, but something might be ascertained by tearing apart the fasciculi after proper treatment to harden the nervous tissue, and soften the connective.

Cimbia.—cmb.—Without seeing Gudden's paper, I have assumed that this is the "*tractus transversus pedunculi*" mentioned by Meynert (A, 737). Something of its course after it enters the crus may be seen from microscopic sections; I have not examined its dorsal end.

Commissura fornicis.—Cs. f.—Is it constant in the cat, and is it represented in man and other mammals. Is it a true commissure?

Crista (*fornicis*).—*crs. f.*—What are its histological composition, its function, and its morphical significance? In what other animals does it exist? See my paper (*7*).

Diatela.—dtl.—The roof of the "third ventricle." What is its histological composition? What is its relation to the *velum*, or the *pia* in general? How are the diaplexuses connected with it?

Diaplexus.—dpx.—Are these formed by the intrusion of the border of the velum, or by only a fold of endyma? See *auliplexus*.

Foramen Magendie.—Fm. Mg.—The alleged communication between the metacœlia "fourth ventricle" and the "subarachnoid space." Does it exist in the cat? What are its exact position and form? Is there more than one? Does it permit the passage of liquid in one or both directions?

Flocculus.—flc.—Is this represented in the cat?

Hippocampa.—hmp.—What is its relation to the fornix and the fimbria?

Insula.—ins.—Is the "Island of Reil" represented in the cat by any distinct elevation? If not, what part of the surface corresponds with it?

Interoptici.—iop.—Is this pair of lobes, discovered by Spitzka (*4*, *5*, and *11*,) in some reptiles, represented in the cat?

Lyra.—ly.—What are its form, extent, connections and manner of formation? Is it in fact a distinct structure, or only a surface?

Metatela.—mtdl.—The membraneous roof of the "fourth ventricle." What are its form, attachments and histological composition? What are its relations to the *metaplexus?*

Myelon and *metencephalon* (medulla). Leaving their histology out of the question, I have not been able to satisfy myself regarding the relations and nomenclature of the visible components of these parts.

Pia (*mater*).—*pi.*—Does it consist of one, two, or more layers? What are the relations of its layers to the *Fissura media*, and to the intervals between the cerebellum and hemispheres, and the cerebellum and medulla?

Portæ.—p.—In my paper (*3*) are given reasons for considering that there are two portæ leading from the mesal aula in the two procœliæ.

Prægeniculatum.—prgn.—Is there not some external or structural line of demarcation between the *thalamus* and the *prægeniculatum?*

Pulvinar.—plv.—Has this any distinct representative in the cat?

Quadrans.—q.—How constant are the inequalities of the surface which enable us, in some cases, to define this area?

Radix intermedia (*rhinencephali*).—*Rx. in.*—Is this ever, in the cat, a distinct root?

Septum lucidum.—Spt. lu.—Is there ever, except in man, any space or *pseudocœlia*, "fifth ventricle," between its two lateral halves? Are these halves ever separated by a prolongation of the pia, or only by connective tissue, or are they ever actually fused so that the true nervous tissue is continuous?

Sulcus habenæ.—Sl. h.—Is the line of reflection of the endyma from the *thalamus* always along the same line, or at the same distance from the habena?

Tænia.—tn.—Is the "*tænia semicircularis*" a distinct band in the cat? If so, what are its relation with the rimá, the proplexus and fimbria?

Terma.—t.—(lamina terminalis). What is its histological composition? Shall the name be held to apply also to the very thin portion of the cephalic wall of the *aula* between the *præcommissura* and the *crista?*

Valvula.—vv.—The roof of the longer and cephalic part of the epicœlia. Does it consist of true nervous tissue, wholly, or even in part, excepting at the place of attachment of the *NN. trochleares?* Is its ectal surface covered by pia? What histological changes occur at its connections with the *cerebellum* and *postoptici?*

Velum (interpositum).—vi.—What is the relation of this to the folds of pia, and to the thalami and fornix?

D.—EXPLANATION OF THE PLATES.

All of the preparations from which the figures are drawn are in the Museum of Cornell University, and are accessible for examination to those who may desire to verify the figures or the descriptions.

In most cases, each figure is based upon more than one preparation. Encephalotomists need not be reminded of the difficulty of obtaining a preparation which shows many points of structure equally well. Since the present paper is only general, and does not aim to indicate individual peculiarities, or those of sex, breed, or age, most of the figures may be regarded as representing what may be called an *average cat's brain.* It is obvious that a very large number of specimens would need to be carefully compared in order to confer upon any generalization respecting sex, etc., a trustworthy character.

It will be noticed that, excepting when there was some special reason for a contrary course, the figures have been uniformly placed in one of two positions. The symmetrical figures are so placed that the meson corresponds with that of the observer, the two sides being right and left like the observer's eyes. The unsymmetrical figures, representing the lateral or mesal surfaces, natural or in section, are usually so placed that the cephalic end points to the left of the observer.

In a short paper (17) the writer has previously urged the desirability of a uniform position for anatomical figures, and suggested that the head end should be always toward the left. As is stated above, while this seems to be most advantageous for unsymmetrical figures, the symmetrical ones are more easily understood and compared in the position which is usually given them.

The obliquity of fig. 17 was necessary in order to show the *Fissura hypocampa* in its whole length. That such a position is undesirable, as a rule, may be inferred from the unwonted emphasis with which it was condemned by the late Prof. Jeffries Wyman :—

"The photograph is from an oblique point of view, which I believe people will never learn to be a bad one. If the view had been full front, or full side, or full anything, it would have been better than this."—The American Naturalist, II, 52.

Most of the figures are twice the diameter of the preparations, and, with the exception of figures 1 and 2, it should have been better to make the enlargement four or five diameters. Aside, however, from the greater expense which this would have involved, such a degree of enlargement would have rendered it not only possible but necessary to show certain details of structure upon which my information is, at present, imperfect.

All of the figures have been drawn from my own preparations by Miss G. D. Clements, B. S., at the time a student in the Natural History Course in Cornell University.

Artists and anatomists who have undertaken to represent the details of encephalic structure understand the difficulties of the task, and will admit that the omissions and inaccuracies to which attention is called in the descriptions are both few and unimportant compared with the general thoroughness of the work. Indeed, for all the deficiencies, I hold myself much more responsible than the artist, by whom some of the figures were drawn at least four times, twice upon stone.

PLATE I.

Fig. 1.—The dorsal aspect of the brain. Enlarged two diameters.

The general form and some of the fissures are drawn from prep's 288 and 289, the bisected brain of a white and Maltese ♀ ; but the fissures of the right hemisphere are derived from several different preparations.

The *Lobi olfactorii* (*L. ol.*) are made somewhat too prominent, but there is considerable difference between cats in this respect, although much less than between dogs.

The general features of the *cerebellum* (*cbl.*) are well shown. The *Lobi laterales* (*L. l.*) have only a fair proportion to the median lobe or *vermis* (*vm.*), instead of the preponderance which they have in the human brain. The lateral contortion which characterizes the caudal aspect of the vermis in adult cats (as shown in my paper, 10, 221, pl. i, fig. 1 and 2) does not affect the dorsal part.

Of the *metencephalon* (*mten.*), and *myelon* (*my.*), the following features

are shown: The *Fissura dorsimesalis* (*F. dms.*), or "Posterior fissure;" the dorsilateral fissure (*F. dl.*); the *Columna dorsalis* (*Clm. d.*), and the *Clm. lateralis* (*Clm. l.*); on the right side, the principal trunk of the *N. accessorius* (*N. ac.*), and the dorsal or sensory funiculi of the first spinal nerve (*N. cv. 1.*).

As already stated, the fissures of the hemispheres are differently represented upon the two sides. The combination of the two kinds of fissural arrangement in a single figure serves to illustrate the extent of the lateral variation and compensation to which attention was called by me in 1873 (10, 232).

The postsylvian and supersylvian (*FF. ps.* and *s.*) are represented as united upon the left side, but separated on the other. The junction is more common, but the separation is sometimes complete. The case is somewhat similar with the *lateralis* and *medilateralis* (*FF. l.* and *ml.*). The *ansate* fissure (*F. an.*) presents itself in so many forms that it is difficult to determine its normal condition and connections. It is usually joined with either the *lateralis* or the *coronalis* or both; when separate, it often is triradiate; but occasionally, as in prep. 294, on the left side, it forms a nearly straight fissure at right angles with the lateralis and coronalis, and wholly independent of them both. This condition is represented on the right side of fig. 1. This fissure demands fuller investigation, especially with reference to its representation in the human brain.

So far as I know, the following junctions of fissures which, on some grounds, may be regarded as fissural integers, are constant in the cat: Of the *rhinal* (*rh.*) with *postrhinal* (*prh.*), and of the *sylvian* (*s.*), with the point of their union; of the *superorbital* (*so.*), with the rhinal; of the *callosal* (*cl.*), with the *hypocampal* (*hmp.*), and with the *precadical* (*prrd.*), when it exists.

The following junctions are common: Of the *diagonal* (*dg.*), with the *anterior* (*a.*); of the *postsylvian* (*ps.*), with the *supersylvian* (*ss.*); of the *medilateral* (*ml.*), with the *lunate* (*ln.*), and with the *lateral* (*l.*), or the *confinis* (*cf.*); of the *marginal* (*mr.*), with the *postmarginal* (*pmr.*); and of the *ansate* (*an.*), with the *lateral* or *coronal* (*cor.*), or both.

The junction of the *cruciate* (*F. cr.*), with the *splenial* (*F. sp.*), which Guillot has seen once, Krueg twice (*Krueg.* 2, 620), and Pansch (7), three times out of fourteen, has been observed by me on only four of the many hemispheres examined. I have never seen a union of the *splenial* with the *postrhinal* (*prh.*).

I have never observed the union of the anterior and posterior fissures to form the "first or lowest arched fissure" of the Canidæ. On the other hand, as stated by Krueg (2, 613), and by myself (11, 229), this union sometimes fails with domestic dogs; hence, in this as in many other respects, the cat presents less tendency to vary.

A junction of two fissures is usually marked by a less depth of the compound fissure at that point, constituting a concealed "transition convolution" or "pli de passage," which may be seen by separating the sides or by slicing off the cortex.

Fig. 2.—The sinistral aspect of the brain. From prep. 288. Enlarged two diameters.

The *Lobus olfactorius* (*L. ol.*) is made somewhat too prominent. The curved line upon its lateral surface indicates, approximately, the boundary of the more cephalic portion of the pero or ectal layer, whence arise the *Nervi olfactorii*. These nerves are not shown.

The features of the *Crus olfactorium* indicated by *lm. cin.* and *lm. alb.* are more fully shown upon fig. 3.

The *Nervus opticus* (*N. op.*) projects from the ventral margin of the figure, and the *Fissura Sylviana* (*F.s.*) is seen dorso-caudad of it.

The ventral end of this fissure, as is always the case in the cat, joins the fissure which forms the dorsilateral boundary of the *Tractus olfactorius* (*Tr. ol.*), and the cephalic and caudal divisions of that fissure are called respectively *rhinalis* and *postrhinalis* (*FF. rh.* and *prh.*). So much of the hemisphere as lies caudad of the *F. Sylviana* forms the *Lobus temporalis* (*L. tmp.*), the ventral extremity of which is the *Lobulus hypocampæ* (*Ll. hmp.*).

The cerebellum (*cbl.*) presents the narrow median lobe or *vermis* (*vm.*), and the *Lobus lateralis* (*L. l.*). Near the ventricephalic angle of the latter, two or three of the laminæ of the second tier project as the *Lobulus appendicularis* (*Ll. ap.*), which is seen better in fig. 3.

The *metaplexus* shown in fig. 3 (*mtpx.*), has been removed, so as to expose the prominent *Eminentia auditoria* (*Em. au.*), whence springs the *N. auditorius* (*N. au.*).

Just ventrad of the eminence is the *trapezium* (*tz.*), and cephalad of this is the *pons* (*pn*).

Between the pons and the hemisphere appears a part of the *Crus cerebri* (*Cr. cb.*), and cephalad of this is the slender *N. trochlearis* (*N. tr.*), which, by inadvertence, seems to emerge from the *F. postrhinalis* instead of from between the cerebellum and the hemisphere.

The *N. trigeminus* (*N. trg.*) has been cut short, in order the more clearly to show that it emerges just caudad of the pons, and not through it as in man.

The remaining nerve origins are indicated only by dots. Those of the *NN. glossopharyngeus*, *vagus* and *accessorius* (*NN. gph.*, *v.* and *ac.*) form a series. At the side of the myelon, near the dorsal and ventral borders, are seen the origins of the first cervical nerve (*N. cv. 1.*).

In this figure the fissures are accurately represented as they are in the preparation, excepting that the small *F. lunata* (*F. lu.*), has been added from prep's 519 and 520. The small *F. intermedia* might well have been inserted between the dorsal ends of the *FF. anterior* and *postica* (*FF. a* and *p*).

PLATE II.

Fig. 3.—The *basis encephali*, or ventral aspect of the brain. Enlarged two diameters.

The proportions and general features are from the brain of an adult ♀.

Maltese and white, prep's 288, 289. Some details of the *Area prachiasmatica* (the region cephalad of the chiasma) are from 461 and 527; of the *Ar. postpontilis* (the region caudad of the pons) from 358, 454 and 491, and of the intermediate *A. cruralis* from 422, 506, and 527.

Most of the nerves and cerebral fissures are lettered on the right side, and most of the other parts on the left. Some of the left nerves are cut short, and the left *N. trochlearis* is not shown at all.

The *Lobi olfactorii* (*Ll. ol.*), and are made too long, and the *hypophysis* (*hph.*) is too short.

Attention is called to the following points, chiefly in comparison with the human brain :—

The absence of a distinct *Radix intermedia* (*Rx. in.*) of the *Crus olfactorium*, corresponding with the so-called "middle root of the olfactory nerve" in man. The part so designated upon the plate is apparently only an area, comparatively undifferentiated, between the more or less fibrous tracts forming the *Radices mesalis* and *lateralis*.

The turning of the *Rx. mesalis* (*Rx. ms.*) over the margin of the brain so as to appear upon the meson.

The distinction of the *Rx. lateralis* (*Rx. l.*) into a lateral gray and a mesal white tract, the *Limes cinerea* (*Lm. cin.*) and the *Lm. alba*.

The great extent of the (*Locus*) *praeperforatus* (*prpf.*), and its division into a cephalic more prominent portion (*Pt. p.*), and a caudal depressed portion (*Pt. d.*). Both portions are "perforated," but the degree of furrowing of the *Pt. prominens* varies considerably. These furrows exist in some other Carnivora.

The width of the *hypophysis* (*hph.*), and the crenation of its caudal border, indicating the existence of an ental subspherical mass, which is covered by an ectal layer, the thinness of which, in the caudal region, permits the contour of the former to be seen.

The slight degree of separation of the *albicantia* (*abm.*), which are here nearly concealed by the hypophysis, but more fully shown in fig. 12.

The distinctness of the *cimbia* (*cmb.*), or "*tractus transversus pedunculi*," which is better seen in fig. 11.

The slight extent of the true *postperforatus* (*ppf.*); the only part which is really "perforated" is a small triangular area just caudad of the albicantia, and partly hidden by them.

The less caudo-cephalic extension of the *pons* (*pn.*); this exposes more of the *Area intercruralis* (*Ar. ic.*) than in man, and uncovers the *trapezium* (*tz.*), which, in man, is wholly concealed. Connected also with this feature of the pons is the fact that the *N. abducens* (*N. abd.*) passes directly cephalad from its origin a little caudad of the pons, whereas in man it is forced to curve around the caudal border. Finally, the *N. trigeminus* (*N. try.*), in place of emerging through the pons as in man, arises wholly caudad of it, although closely applied to its surface.

The greater extent of the *Ar. cruralis*, which may be ascribed both to

the less extent of the pons, and the less degree of flexure of the whole brain at the mesencephalic region.

The greater width of the *Tractus postrhinalis* (*Tr. prh.*), which includes the surface of the *Lobulus hippocampi* (*Ll. hmp.*). In man, indeed, this part is hardly visible on account of the prominence of the convolutions laterad of the *F. postrhinalis*.

The apparent origin of the *N. oculomotorius* (*N. ocm.*) laterad of the meson, and just caudad of the cimbia (*cmb.*).

The appearance of a division of the ectal layers of the pontile fibres into three groups, cephalic, caudal and intermediate, the latter partly overlapped by the other two.

The appearance of a faint band crossing the trapezium a little obliquely between the origins of the *NN. abducens* (*N. abd.*) and *facialis* (*N. f.*). The distinctness of this band varies.

The origin of the *N. hypoglossus* (*N. hg.*) laterad of the *Area elliptica* (*Ar. el.*), which might otherwise be taken as the surface of the *oliva* or "olivary body" of man. The determination of this point involves some comparisons and sections which I have not yet made, so I merely indicate the part by a descriptive name and leave the question open.

The close association of the roots of the *NN. glossopharyngeus* (*N. gph.*), *vagus* (*N. v.*), and *accessorius* (*N. ac.*). The long caudal nerve is of course accessorial, and the cephalic funiculi are unquestionably glossopharyngeal; but how the intermediate funiculi should be assigned, I am not yet sure.*

The marked prominence of the ventro-lateral region of the metencephalic continuation of the *Columna lateralis myelonis* (*Clm. l.*), forming an elevation to which I have applied the provisional name *Area ovalis* (*Ar. ov.*).

The absence of any superficial decussation of the *pyramids* (*py.*). Hence, the *F. ventrimesalis* (*F. vms.*) or "anterior fissure," is uninterrupted. The *F. ventrilateralis* (*F. vl.*) is deflected at the caudal end of the *Area elliptica*.

Fig. 4.—The mesal surface of the right half of the brain (hemiencephalon dextrum). Enlarged two diameters.

The general features are from the same brain as fig. 3, but some features are derived from prep's 290, 304 and 454.

The surfaces shown in this figure are of four kinds, as follows :—

1. The natural surfaces which are covered by *pia*. These are the mesal aspects of the *hemisphere* (*hem.*), and the *Lobus olfactorius* (*L. ol.*).

2. The natural mesal surface (*Ar. spt.*) of the right half of the *septum lucidum*, which, in the cat, is in contact with its lateral homologue, or separated therefrom only by a thin layer of connective. I have never observed an interval corresponding to the *pseudocœlia* or "fifth ventricle" of man.

*In a paper on the N. vagus in the cat, presented at the same time with this, Prof. T. B. Stowell has given a fuller account of the relations of these nerves.

3. The natural endymal surfaces of the true *cœliæ* or "ventricles." Of course the "lateral ventricles," procœliæ, do not appear.

4. The cut surfaces of the *commissures* and other parts which cross the meson, or lie upon it. In the *cerebellum* (*cbl.*) the relative areas of the ental *alba* and the ectal *cinerea* forming the *arbor vitæ* (*arb.*), are indicated by the shading; with less definiteness, the alba is shown in the *callosum* (*cl.*), the *fornix* (*f.*), the *præcommissura* (*prcs.*), the postcommissura (*pcs.*), the *commissura habenarum* (*cs. h.*), and the *chiasma* (*ch.*). The section of the *medicommissura* (*mcs.*) should appear as if composed, at least chiefly, of cinerea, but no attempt has been made to indicate the nature of the cut surfaces of the *Crista fornicis* (*Crs. f.*), the *terma* (*t.*), the *hypophysis* (*hph.*), the *infundibulum* (*inf.*), the *basicommissura* (*bcs.*), the *conarium* (*cn.*), the *optici* and *postoptici* (*op.* and *pop.*), the *valvula* (*vv.*), the *Crura cerebri* (*Cr. cb*), the *metatela* (*mttl.*), or the rest of the epencephalon and metencephalon (*mten.*). The extent of the transverse fibres of the *pons* (*pn.*) should have been represented, at least approximately.

So much of the cephalic boundary of the *aula* (A.) as intervenes between the *præcommissura* (*prcs.*) and the *crista* (*Crs. f.*) is very thin, and is too indistinctly shown in the figure. Neither here nor at any other point is there any such interruption of the wall as would form a communication between the true cœliæ and the pseudocœlia or the ectal surface of the brain. It is probable that the presence of such a communication as is ascribed to the human embryo, and to some animals in Quain (A, II, 543), is due to the artificial rupture of the natural connections.

Attention is called to the following points, chiefly in comparison with the human brain :—

The appearance of the *Rx. mesalis* (*Rx. ms.*) on the meson, and the presence of two shallow fissures, *postradicalis* and *præradicalis* (*FF. prd.* and *prrd.*) between it and the adjoining surfaces of the hemisphere.

The large size of the commissures, especially the *medicommissura* which nearly fills the diacœlia (*dc.*).

The non-appearance of the *porta* when the meson is viewed squarely; it is doubtful whether the human "foramen of Monro" is really visible from the meson.

The less extent of the *callosum*, especially of its rostrum (*rm.*). In some human brains the rostrum does not extend so far as is usually represented.

The darker spot on the section of the hypophysis represents the space occupied by the ental mass, which has been removed.

The relations of the pia are not indicated at all, and are not well understood, especially between the cerebellum and the metencephalon and mesencephalon.

PLATE III.

With the exception of fig. 13, all the figures upon this plate represent the natural surfaces of regions which are more or less completely concealed by other parts in the undissected brain.

Fig. 5.—The cephalic aspect of the Prosencephalon after the removal of the *Lobi olfactorii*. From prep. 294. Enlarged two diameters.

The hardened brain was transected at the *FF. postica*, so that the preparation includes only the cephalic two-thirds of the prosencephalon.

The drawing represents the preparation tilted up so as to expose the ventral aspect foreshortened.

As compared with fig. 6, this might well have been made of the natural size. A less regularly symmetrical brain would have been more instructive. One of the *Crura olfactoria* should have been divided at a little greater distance from the prosen.

So far as appears in the figure, the fissures are remarkably alike upon the two sides; the left *F. ansata* (*F. an.*) however, only the meso-cephalic end of which appears in the figure, presents the somewhat unusual but very suggestive condition of entire independence of the *F. lateralis* (which is invisible) and the *F. coronalis* (*F. cor.*). On the right side it is joined by the former fissure.

The right *F. sylviana* (*F. s.*) is shorter than the left, and presents a slight terminal bifurcation which is not shown.

In consequence of the removal of the *Lobi olfactorii*, and the tilting of the whole preparation, so much of the *F. rhinalis* (*F. rh.*) as lies cephalad of its union with the *F. superorbitalis* (*F. so.*) is practically obliterated, and the remainder of it is so foreshortened as to appear as an insignificant intermediate portion of an extensive u-shaped fissure formed by the *FF. sylviana* (*F. s.*) and *superorbitalis* (*F. so.*). The appearances thus presented are suggestive in view of the idea of Meynert (*1*, 12), which I also entertained at one time (10, 225), that the *F. superorbitalis* represents the "anterior branch" of the human *F. sylviana*, and that the intervening part of the brain corresponds to the "operculum."

A slight preponderance of the left hemisphere just caudad of the F. sylviana is somewhat exaggerated in the figure, and the *Crura olfactoria* (*Cr. ol.*) should differ less in form and in their distance from the meson.

The *FF. olfactoriæ* (*F. ol.*) appear as little more than shallow furrows.

On account of the foreshortening of the ventral aspect, the line of separation of the *Portio prominens* (*Pt. p.*) and the *Pt. depressa* (*pt. d.*) is indistinct. The *Ll. hypocampæ* (*Ll. hmp.*) on each side has been flattened by pressure, and is so represented.

Fig. 6.—The caudal aspect of the Prosencephalon, with part of the Diencephalon, after the removal of the other parts of the brain.

From prep. 292, an adult ♀.

The dien. has been transected so as to leave a concave surface which, at the meson, is close to the caudal border of the medicommissura (*mcs.*), but rises at the sides so as to coincide nearly with the caudal surface of the prosencephalon.

The postcommissura has been removed, and the slender transverse band (*Cs. h.*). Just ventrad of the *splenium* (*sp.*) is the *Commissura habenarum*.

Had the postcommissura been left, the intervening space would be a foramen, *Fm. conarii*.

The shallow depression of the ventricaudal surface of each hemisphere just laterad of the splenium, represents the area of contact of the *opticus*.

The cerebral fissures are markedly unsymmetrical, and thus in contrast with those of fig. 5. The right *F. postrhinalis* (*F. prh.*) is the longer, and the right *postsylviana* (*F. ps.*) joins the *F. supersylviana*, although the place of union does not appear in the figure. On the contrary, by reason of the perspective, it seems to be joined by the *F. medilateralis* (*F. ml*).

The *LlLl. hypocamparum* have their proper rounded form in this preparation.

Part of the *diacælia* (*dc.*) appears dorsad of the medicommissura, and part on its ventral side. In man, the commissure is smaller, and the cœlia correspondingly more extensive. On account of the removal of the hypophysis and infundibulum, the diacœlia opens freely at the *Fm. infundibuli* (*Fm. inf.*).

Fig. 7.—The dorsal aspect of the Diencephalon (thalami and geniculata), and of the Mesencephalon (optici and postoptici).

From preps. 397 and 494, adult ♀♀, 423, a nearly adult ♀, and 506. Enlarged two diameters.

The principal features of this figure were drawn from prep. 506. The preparation was made by lifting the caudal ends of the hemispheres, and gradually separating them, with the callosum, fornix and velum, from the subjacent parts. The epen. and meten. were then removed by a transection just caudad of the postoptici.

The *calcula* (*cv.*) was torn from prep. 506, so it is drawn as it appeared in prep. 494, after inflation by blowing air from the diacœlia through the mesocœlia or *iter*.

The *Commissura habenarum* (*Cs. h.*) is really more distinct in prep. 397 than appears in the figure. The habenæ (*h.*), their sulci (*Sl. h.*) and the lines of reflection of the endyma are taken from prep. 422, and their distinctness is not exaggerated in the figure. Their morphical significance is to be noted in connection with the general question of cœlian circumscription. Upon this point, see a brief note in "Science" (*12*).

The complete roof of the diacœlia, the *diatela* (*dtl.*), is shown in fig. 10.

As compared with the homologous parts in man, the feline *postoptici* (*pop.*) and *geniculata* (*pgn* and *prgn.*) are larger, while the *thalami* (*th.*) seem to be only the mesal continuations of the *pregeniculata* (*prgn.*), and to lack altogether the pulvinar or "posterior tubercle" of man.

Fig. 8.—The caudal aspect of the Mesencephalon, with parts of the adjoining regions. From prep. 506.

The plane of transection coincides nearly with the caudal surface of the *postoptici* (*pop.*), and has divided the *pons* (*pn.*), a little caudad of its middle. The *valvula* (*vv.*) was torn from this preparation, and the line of its attachment is not distinctly shown. Something of its position may be judged from fig. 7. The caudal orifice of the iter or *mesocœlia* (*msc.*) is

shown here as a nearly regular circular spot; in reality, it presents a slight mesal extension at both the dorsal and ventral sides. Indeed, when carefully examined, the so-called "aquæductus sylvii" is far from being a perfectly simple and uniform tube; its form in man is indicated in Reichert's fig. 31 (A, taf. 4). Among the lower mammals it is usually larger, and with the lower vertebrates it often has the proportions of a true cœlia, with lateral extensions.

The *cimbia* (*cmb.*) is partly seen on the right. The *geniculata* (*pgn.* and *prgn.*) do not project as far as they should. The optici are wholly hidden from view by the prominent *postoptici* (pop.).

Fig. 9.—The sinistral aspect of the Mesencephalon and Diencephalon. From preps. 491 and 506. Enlarged two diameters.

The only cut surface shown in this figure is that caused by the oblique transection between the dien. and the prosen.; the plane of section followed the cephalic border of the *Tractus opticus* (*Tr. op.*), and corresponds with the *Sulcus limitans* between the *thalamus* and the *striatum*.

Crossing the *crus* (*Cr. cb.*) just caudad of the *postgeniculatum* (*pgn.*) is seen the *cimbia* (*cmb.*).

The *Nervus trochlearis* (*N. tr.*) had been removed from prep. 506, and was added from prep. 491.

Upon this figure should appear the *Lemniscus superior* and *L. inferior*, and the *postbrachium* and *prebrachium*, provided they exist in the cat as distinct parts visible at the surface. I have not been able to satisfy myself respecting their exact position and limits in the human brain, and refrain from expressing any opinion concerning them.

Fig. 10.—The dorsal aspect of the Diencephalon, including the diatela. From prep. 301, a half grown ♂.

The object of this figure is to show the existence of a *distinct roof of the diacœlia* independent of the velum, which has been removed. This *diatela* (*dtl.*) presents the appearance of something more than the lining endyma, but its structure has not, so far as I know, been examined. The darker triangular area at the cephalic end of the diatela corresponds with the *delta fornicis* (*dlt. f.*).

Fig. 11.—The Area cruralis, with part of the pons and of the Ar. prechiasmatica. Enlarged two diameters. From preps. 506, 425 (nearly adult ♀) and 461 (♂).

So small and so numerous are the parts shown in this figure, that it should have been yet more enlarged.

The *Lobi temporales* have been divided at different levels on the two sides. From the right, only the extremity, or *Ll. hypocampæ*, has been removed, and the section of the *medicornu* (*mcu*) which is here cut very obliquely, is a slightly curved space completely circumscribed by a nervous wall. Neither in the cat, nor—contrary to the common belief and the explicit statement in Quain, A, II, 542, 544—in man, does the *rima* or "great transverse fissure" extend to the *tip* of the medicornu.

Where the *Ll. hypocampæ* rests against the *Tractus opticus* (*Tr. op.*),

there is usually a deep notch which may be called the *Incisura hippocampæ* (*Inc. hmp.*).

On the left side, the hemisphere was dissected off so as to leave two cut surfaces. One of these surfaces is plane and nearly horizontal, and lies at about the level of the dorsal end of the *postgeniculatum* (*pgn.*). The other is convex, and extends from the cephalic border of the former obliquely to the ventral surface of the brain: it corresponds closely with the cephalic border of the *Tractus opticus* (*Tr. op.*).

The left *medicornu* is cut at about the middle, and at nearly a right angle with its course; hence its lumen presents its characteristic crescentic section, the ectal boundary being the convex surface of the *hypocampa* (*hmp.*).

The cephalic margin of the medicornu is here seen to reach the surface of the hemisphere close to the *Tractus opticus*, and this narrow line of interruption of the true nervous wall of the cornu constitutes the *rima*. The scale upon which this figure was drawn did not permit the relations of the *pia*, the *velum*, and the *proplexus* to be shown, and the undulations of the ectal surface, corresponding with the *FF. hypocampæ* and *fimbriæ*, and the *fasciola* and *fimbria* are hidden by the projecting postgeniculatum.

Most of the cephalic portion of the brain has been removed, but the *Portio depressa* (*Pt. d.*) of the *præperforatus* is seen, with part of the *Pt. prominens* (*Pt. p.*). The removal of most of the *chiasma* (*ch.*) exposes the form and extent of the *Recessus opticus* (*R. op.*).

The *pons* has been transected obliquely, and its caudal portion removed together with the rest of the epen. and the metencephalon.

The left *Crus* (*Cr. cb.*) is seen in its whole length, excepting a small part concealed by the slightly projecting cephalic border of the pons. The well-marked *cimbia* (*cmb.*) may perhaps be regarded as the boundary between the diencephalic portion of the crus (*Pt. dien.*) and the mesencephalic portion (*Pt. msen.*), which more directly supports the *optici* and *postoptici;* in man, this part seems to be almost wholly concealed by the pons.

The right *N. oculomotorius* (*N. ocm.*) is seen to emerge from the crus just caudad of the mesal end of the cimbia, and just laterad of the *Sulcus intercruralis lateralis* (*Sl. ic. l.*). A marked longitudinal ridge of the crural fibres separates from the *postgeniculatum* (*pgn.*) the depressed area which, from its forming approximately the fourth of a circle, I have called the *quadrans* (*q.*).

The *albicantia* (*abn*) are more closely united than in man, but they are large, white, and perfectly distinguishable. The shallow furrow between them, together with the u-shaped furrow which forms their cephalic boundary, may be named *Sulcus triradiatus* (*Sl. trd.*).

The hypophysis has been removed so as to expose the *Tuber cinereum* (*T. cin.*), and the thin raised margin of the *Fm. infundibuli* (*Fm. inf.*).

Just caudad of the albicantia, and partly overhung by them, is a small triangular depressed space with distinct perforations; this seems to be the true *postperforatus* (*ppf.*).

The entire *Area cruralis* may be more completely exposed by removing the cerebellum and dorsiducting the medulla, as in prep. 425.

Fig. 12.—The dorsal aspect of the Metencephalon or Medulla, showing the metatela or roof of the metacœlia. From prep. 397, adult ♀, 464 and 491.

The metatela here shown is apparently independent of the *pia;* like the diatela it seems to consist of more substantial tissue than simply endyma, but I am not aware that its microscopic structure has been ascertained. I am in doubt respecting the precise limits and attachments of the metatela, and the form and location of the "foramen of Magendie." Hence the figure is vague and unsatisfactory upon these points.

Fig. 13.—Part of an oblique transection of the Prosencephalon and Diencephalon to show the form and position of the *crista*. From prep. 441. Enlarged two diameters.

The brain was transected obliquely at an angle of about 45 degrees with the general longitudinal axis. The plane of section passed from a point nearly dorsad of the genu, through the aula, the medicornua and the albicantia. The figure includes only a part of the caudal aspect of the slice.

The dorsal borders of the hemispheres are divaricated slightly, and the *callosum* (*cl.*) is seen crossing the interval; the slight notch on each side just dorsad of the callosum is the *F. callosalis* (*F. cl.*).

The *striata* (*s. s.*) are seen in section just ventrad of the lateral expansion of the callosum, while the lower part of the figure is occupied by the thalami (*th*), united by the *mediocommissura* (*mes.*). Between each thalamus and the corresponding striatum is a groove, the *Sulcus limitans* (*Sl. li.*).

The *Columnæ fornicis* (*Clm. f.*) are divided nearly at a right angle with their course, and at a point just dorsad of the *crista* (*crs. f.*), which is particularly well shown in this preparation. The open space between the fornix and the thalami is the *aula* (*a.*), and on each side are the *portæ* (*p.*) leading into the *procœliæ*. All the plexuses have been removed.

PLATE IV.

Unlike those of Plate III, all of the figures upon this plate represent cut surfaces, although some natural surfaces are shown also.

Fig. 14.—A ventricaudal view of the *fornix*, with the adjacent parts. From prep's. 507, 463 and 396 (adult ♂). Enlarged two diameters.

The preparations were made while the brain was fresh, so as to permit more flattening of the hemispheres, and consequent exposure of the fornix.

After the removal of the rhinen., meten., epen. and mesen., the thalami and geniculata were excavated piecemeal, so as not to injure or displace the fornix. The cut surface (*s.*) at each side of the fornix (*f.*) is the plane of division of the dien. from the striatum.

The cephalic end of the prosen was then sliced down to the level of the *precommissura* (*prcs.*), which is seen to send a distinct fasciculus toward the rhinen. on each side. Then the right hemisphere was sliced obliquely

from near the meson dorso-laterad so as to cut the *medicornu* (*mcu.*) and *hippocampa* (*hmp.*) at about the middle of their length. On the left side, the *L. temporalis* was allowed to fall somewhat by its own weight so as to expose the fornix more fully.

The *velum* and all the *plexus* were removed so as to display the peculiar markings of the fornix and its mesal portion which is supposed to represent the *lyra* (*ly.*).

The *portæ* (*p.*) appear both shorter and narrower than they really are, on account of the obliquity of their planes to the line of vision. The v-shaped line called *ripa* (*rp.*) which connects the two portæ, separates the *delta* (dlt.) or entocœlian part of the fornix from the remaining surface, which is wholly outside of the cœlian cavity. The delta forms the roof of the *aula*, the cephalic continuation of the diacœlia between the two portæ, and the ripa is the line of reflection of the *endyma* upon the two *auliplexus*; the removal of these plexuses causes the rupture of the endyma along the ripa.

At each side, the ripa curves dorsad somewhat sharply so as to reach the dorsal end of the porta; at this point, and dorso-caudad for the entire length of the *rima* (*r.*), the endyma is simply reflected from the contiguous surfaces of the *fimbria* (*fmb.*) and the corresponding border of the *striatum*. Hence the rima is virtually *closed*, and thus wholly distinct from the porta.

On the meson, between the portæ, is seen the *crista* (*crs. f.*), which is unusually rounded in this preparation. The *carina*, which sometimes appears as a slight mesal ridge extending dorso-caudad from the crista, does not appear in this preparation. The *Recessus aulæ* (*R. a.*) is the cleft between the two *Columnæ fornicis* (*Clm. f.*) whose cut ends are seen just caudad of the præcommissura. The shading on the caudal aspect of the columnæ indicates, but rather too distinctly, a slightly depressed area, of which the dorsal part, close to the crista, sometimes presents the appearance of a transverse band, for which I suggest the name *Commissura fornicis* (*Cs. f.*).

After a prolonged examination of many preparations, I am unable to define accurately the limits of the fornix and the *lyra* (*ly.*). A comparison of the accounts given in standard works with the appearances presented by the limited materials at my disposal, leads me to doubt whether the relative extent of the two parts in the human brain is well determined.

The *fasciola* (*fscl.*) is thick, and no part of it presents the denticulations from which its more ventral portion, in man, is called "fascia dentata." The peculiar curve of the hypocampa, medicornu and fasciola is well indicated by the fact that the *F. hippocampæ* (*F. hmp.*), which corresponds nearly with them in direction, is visible in this preparation only at its two ends, near the *splenium* (*sp.*), and near the tip of the *Ll. hippocampæ* (*Ll. hmp.*). Between the fimbria and the fasciola is a depressed line which may be called the *Fissura fimbriæ* (*F. fmb.*).

Fig. 15.—The dorsal aspect of the *procœlix*, with their *proplexus*. From prep. 465. Natural size.

The especial object of this preparation is to show that, in the cat, *no part of the thalamus appears in the procœlia*. The cerebellum (cbl.) is shown only in outline.

Both hemispheres were sliced from the dorsum to the level of the intermediate part of the *callosum* (*cl.*). This laid open both procœliæ in some degree. The central part of each procœlia is sometimes called *cella media* (*cel. m.*). The right medicornu was then opened to the tip which, however, cannot be seen from the dorsal side.

The floor of the procœlia is seen to be formed by the *striatum* (*s.*), the *fornix* (f.), and the *hippocampa* (hmp.). The proplexus have been turned in opposite directions for the sake of showing the absence of any interval between the fornix and hypocampa—or the fimbria which forms the border of the latter—and the striatum, such as would permit the appearance of the thalamus in the procœlia. Whatever may be the case in man, neither in the cat nor in any other mammal examined by me, is there any separation of the borders of the rima more than will permit the intrusion of the border of the velum to form the proplexus.

It is commonly stated in works upon human anatomy that the thalamus appears in the "lateral ventricle," forming part of its floor. It is possible that the narrowness of the human fornix may permit this to occur; but the part of the thalamus so appearing must be covered by endyma, and should be so described in contradistinction to the larger portion of its dorsal aspect, which is certainly ectocœlian. However this may be in man, it is not the case in any other mammal examined by me, and the explicit statement in both the French and the English editions of Chauveau's "Anatomy of domesticated animals," that the thalami appear in the lateral ventricles in the horse, ox, pig and dog, and, by implication, all other members of their several groups, should not be accepted without definite descriptions and figures.

Fig. 16.—From preps. 425 and 493. Enlarged two diameters.

This figure shows the *continuity of the procœlia with the rhinocœlia*, and its *communication through the porta with the aula and diacœlia*.

The right half of the brain was transected through the caudal part of the *medicommissura* (*mcs.*). A slice was then cut from the mesal aspect so as to include the *genu*. This exposed the *præcornu* (*prcu.*) with the mesal aspect of the *striatum* (*s.*), the *rhinocœlia* (*rhc.*), and the relative extent of the *pes* (*ps.*), and the *pero* (*po.*) of the *Lobus olfactorius*. A *bristle* was then passed through the *porta* from the præcornu into the *aula* (*a.*). Just ventrad of the bristle are the *præcommissura* (*prcs.*), and the *terma* (*t.*). The latter is traced distinctly to the *chiasma* (*ch.*), so that the cephalic wall of the cœlian cavity is complete. The deeper shadow just dorsad of the chiasma indicates the position of the *Recessus opticus* (*R. op.*).

Just dorsad of the bristle, the *crista* (*Crs. f.*) is seen divided upon the meson, and continuous with the *Columna fornicis* (*Clm. f.*). The indentation between the crista and the præcommissura corresponds with the *Recessus aulæ* (*R. a.*). The triangular *Area septalis* (*Ar. spt.*) between the

fornix and the callosum, is the mesal surface of the right half of the *Septum lucidum* (*Spt. lu.*) and is in contact with its *platetrope* or lateral homologue in the undissected brain. The thickness of the lateral laminæ constituting the septum render the adjective *lucidum* wholly inapplicable.

Fig. 17.—The mesal aspect of the right hemisphere, with the Lobus olfactorius. From prep's 296 and 401.

The caudal divisions of a half-brain were removed, and the thalamus carefully excavated so as to leave undisturbed the *fornix* (*f.*) and the *fimbria* (*fmb.*). In this respect, this figure may be compared with the left half of fig. 14.

The special object of this figure is to show the *F. hypocampæ* (*F. hmp.*), in its whole length at once. So great is the curvature of the parts that this is possible only in a single position of the preparation in which the meson is foreshortened. In general, this figure may be compared with those given by Flower (13) of the rabbit and sheep.

The dorsal end of the *F. hypocampæ* is seen to turn sharply around the *splenium* (*sp.*), so as to become continuous with the *F. callosalis* (*F. cl.*). The *fasciola* (*fscl.*), is wide, and devoid of denticulations, but is crossed obliquely by a shallow furrow. In this position of the preparation, the *F. fimbriæ* (*F. fmb.*), appears to be continuous with a short line passing cephalad to a point ventrad of the callosum; in reality, however, this latter line is only one of the markings of the ventral surface of the fornix, and the *F. fimbriæ*, like the *F. callosalis*, turns sharply dorso-caudad to terminate just cephalad of the splenium.

Fig. 18.—The *right procœlia* seen from the right or ectal side. From prep. 495.

The right half of the brain was removed in successive slices until what remained was about 3 mm. thick. The remainder of the *striatum* was then everted from the *præcornua* (*prcu.*). The *proplexus* (*prpx*) is slightly displaced, but the *porta* is hidden by the *portiplexus* (*ppx.*). The medicornu (*mcu.*), and the *hypocampa* (*hmp.*), are shown in section, and the other parts will be readily recognized. The relative heights of the *opticus* (*op.*), and the *postotpicus* (*pop.*) at a little distance from the meson are well displayed. The short curved line at the cephalo-ventral end of the procœlia represents the beginning of the passage to the rhinocœlia.

Fig. 19.—The *left præcornu* and *porta* exposed from the left or ectal side. From prep. 495.

This figure represents the other side of the same brain as that from which Fig. 19 was drawn. The preparation was made in the same way, but in addition the proplexus and portiplexus were carefully snipped off so as to expose the porta.

The *porta* (*p.*) is seen to open between the *Columnæ fornicis* (*Clm. f.*) and the cephalic end of the *thalamus* (*th.*). The orifice would appear larger if the preparation had been so placed as to leave its plane parallel with the picture-plane.

The membranes could not be shown well on so small a scale. In this and in the previous figure the fornix is seen to be continuous with the *Septum lucidum* (*Spt. lu.*) which forms part of the mesal wall of the *præcornu*.

Fig. 20.—Transection of the *fornix* with the *crista*. From prep. 508.

The object of this figure is to show the decided elevation formed by the *Crista* (*Crs. f.*). Only enough of the rest of the section is included to locate the crista.

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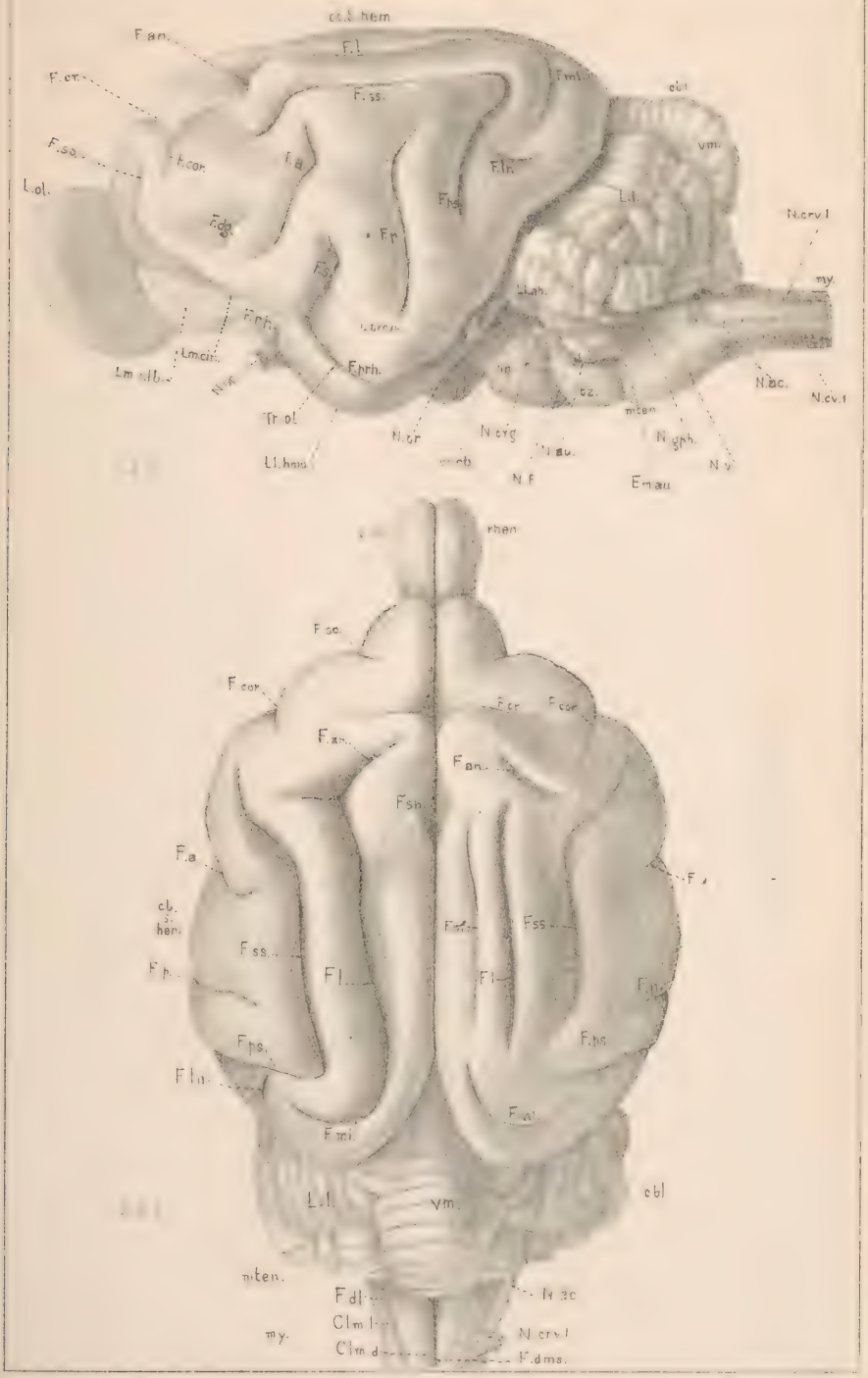
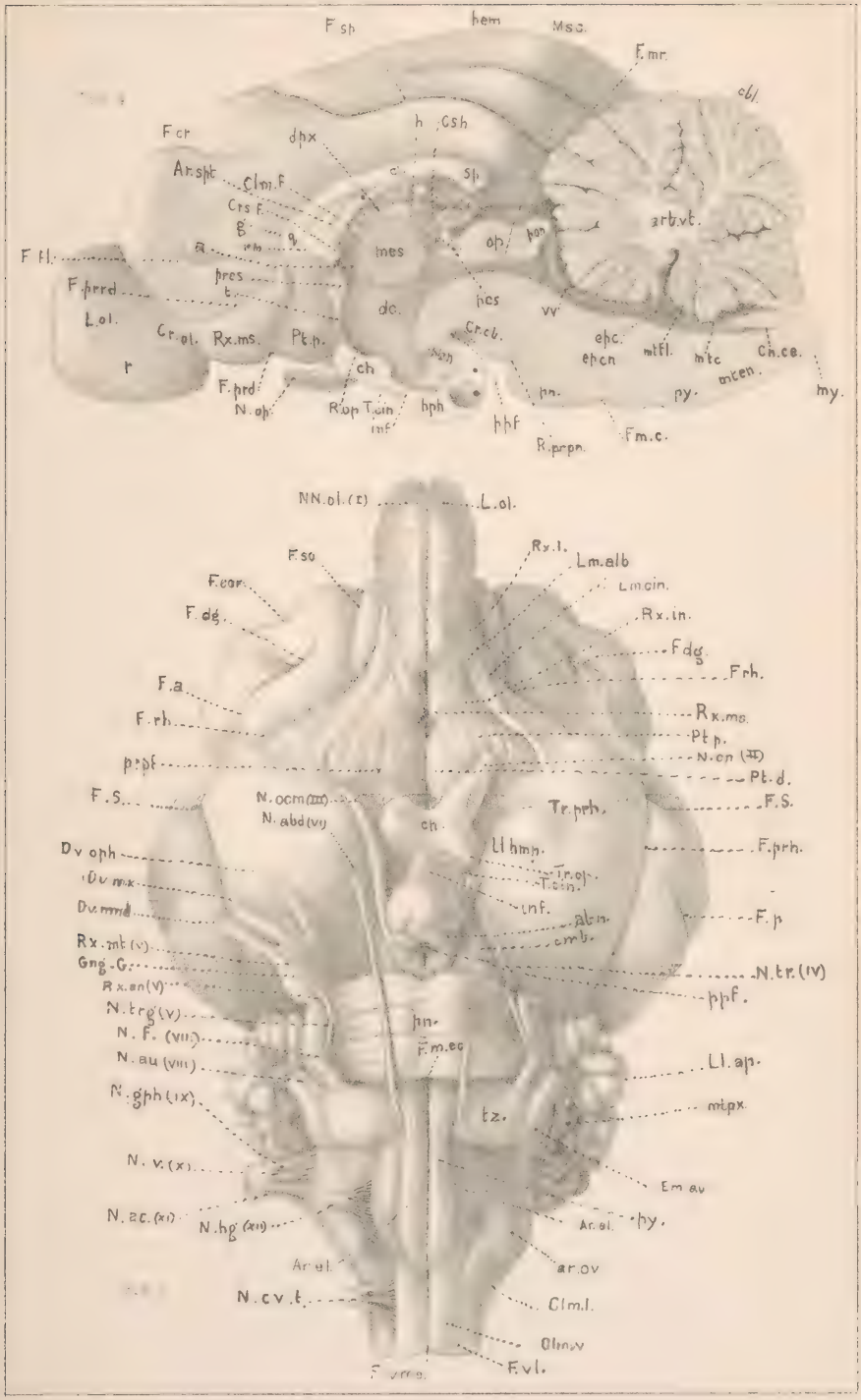
Addenda.—Concerning the morphical relations and significance of the *conarium* and the *hypophysis*, see the paper by Prof. Owen, read before the British Association in 1881, and reported in "Nature" for Sept. 22, 1881.

In his Report for 1880, as Entomologist of the U. S. Dept. of Agriculture, my colleague, Prof. J. Henry Comstock, expresses (p. 284) his approval of most of the toponomical terms proposed in the present paper (p. 531) and employs them in the descriptions of insects therein contained.



WILDER ON BRAIN OF CAT



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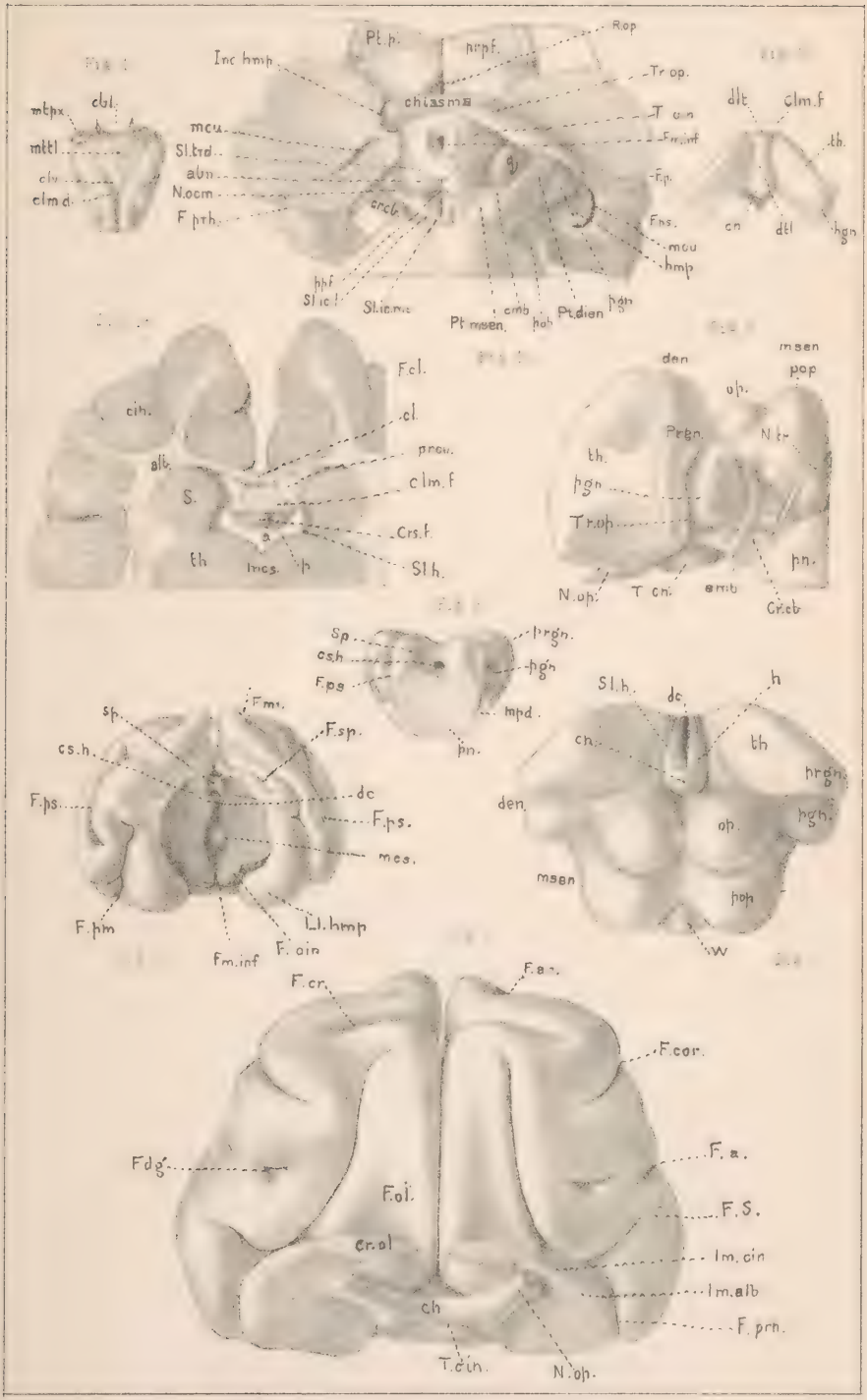

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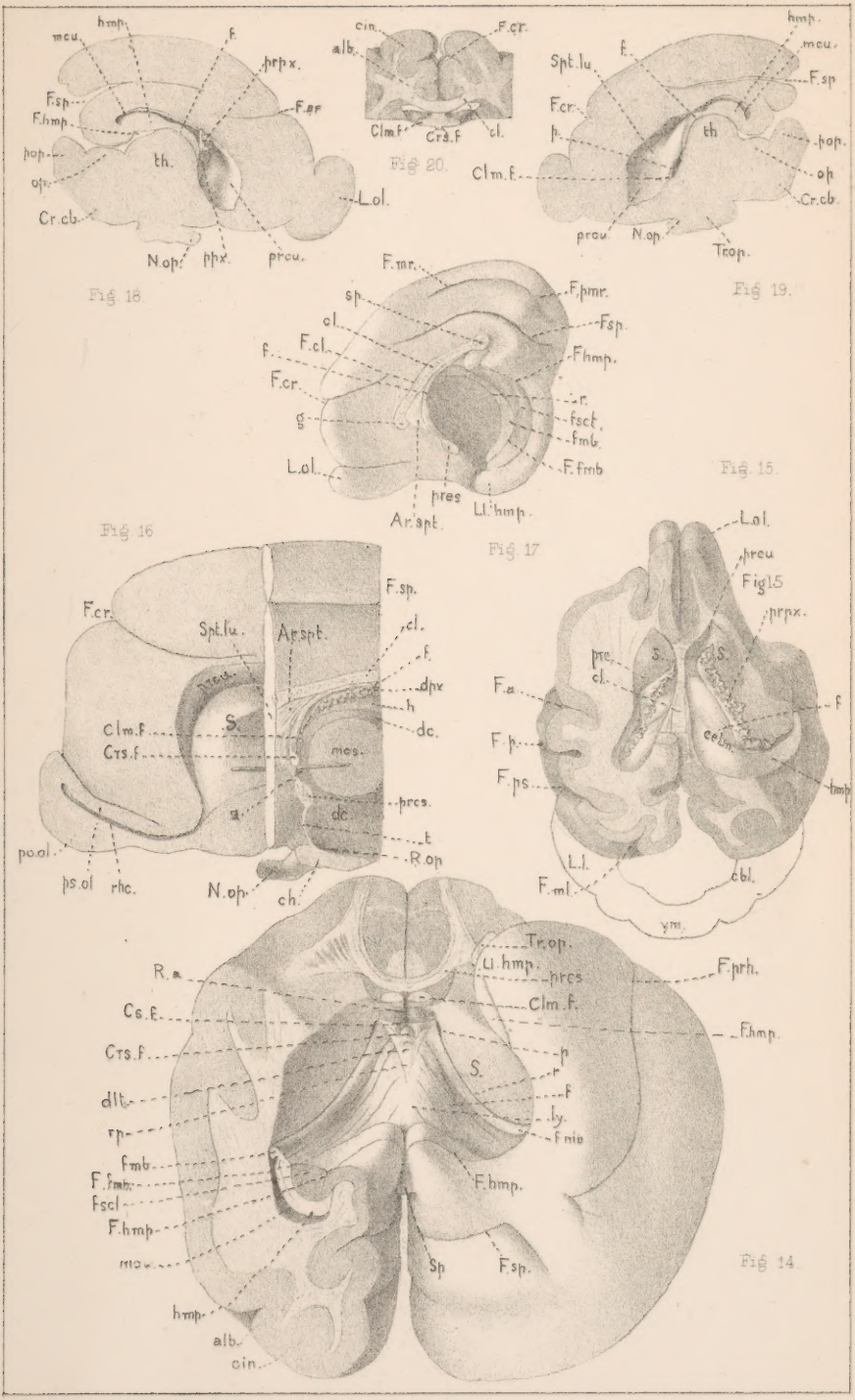

Fig 18 Fig 20. Fig 19. Fig 16 Fig 17 Fig 15. Fig 14